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### *Shaping the Construction/Society Nexus : Executive Summaries*

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# 6th Nordic Conference on Construction Economics and Organisation

– Shaping the Construction/Society Nexus

*Executive Summaries*



Danish Building Research Institute  
AALBORG UNIVERSITY



EDITED BY:

Kim Haugbølle, Stefan Christoffer Gottlieb, Kalle E. Kähkönen,  
Ole Jonny Klakegg, Göran A. Lindahl & Kristian Widén





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Edited by:

Kim Haugbølle, Stefan Christoffer Gottlieb, Kalle E. Kähkönen,  
Ole Jonny Klakegg, Göran A. Lindahl & Kristian Widén

13-15 April 2011

Danish Society of Engineers Conference Centre, Copenhagen, Denmark

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Organising Committee's declaration:

All the papers in this book of executive summaries were double-blind refereed at abstract and full paper stage by members of the scientific committee. This process involved, detailed reading of the abstracts and papers, reporting of comments to authors, modifications of papers by authors and re-evaluation of re-submitted papers to ensure quality of content.

## FOREWORD

On behalf of the Organising Committee, it is my pleasure to welcome you to Copenhagen and the Conference Centre of the Danish Association of Engineers for the 6th Nordic Conference on Construction Economics and Organisation.

When we commenced with the planning of the this year's conference, we had great hopes and expectations to be able to invite you to the largest Nordic Conference on Construction Economics and Organisation yet, along with a number of associated events, and with papers of high scientific rigour and quality – and we are pleased to announce that our expectations have been fulfilled.

Focusing on the nexus between construction and the built environment, we invited papers that would explore the various ways in which construction and the use of constructions are interlinked and mutually constituting and transforming each other. We received more than 150 abstracts, which through a double-blind peer review process resulted in some 60 papers being published here in these proceedings under the theme: “Shaping the construction/society nexus.” The published papers are of a high quality and display a growing tendency with our field of research: namely the application of theoretically informed approaches to raise the quality of the analyses and the generalisation of conclusions.

The road to the conference has, however, been long and arduous, which has presented organisers, committee members, reviewers and authors with a series of minor and major technical and organisational issues. We apologise and are at the same time confident that these sorts of problems will be a thing of the past when the 7th Nordic Conference on Construction Economics and Organisation will be held in 2013.

Thus, in the two years until the next conference, we will work hard to establish a more professional or at least a more permanent, organisation behind the conference series by forming a Nordic Association of Researchers in Construction Economics and Organisation. We have already taken the first step by signing a Memorandum of Understanding with our friends in both ARCOM and CIB who have cordially helped us promote this year's conference. It is our hope that we in the years to come will be able to return the favour and help develop the field of construction management for the benefit of all of us.

An event like this is only possible with the help of many individuals and organisations. First and foremost, I wish to thank the members of the Organising Committee and in particular Stefan Christoffer Gottlieb and Göran Lindahl. Further, I would like to thank all members of the Scientific Committee, who have helped us maintain a high standard and quality of papers. Finally, I would like to thank our partners and sponsors for their collaborative contributions and financial support.

I wish you a pleasant and profitable conference.

Kim Haugbølle  
6th Nordic Conference Chair  
Danish Building Research Institute, Aalborg University



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# THE PROCESS OF CHANGE AND GREEN INSTITUTIONAL ENTREPRENEURS

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*The notion of sustainability and the mission of environmental management towards sustainable development is the combined outcome of adapting environmental methods and products. In Order to develop new strategies, organizations recognize institutional entrepreneurs as those who shape and change organizations. Actors who contribute with the new and innovative strategies are called institutional entrepreneurs. Likewise, actors who work to establish the environmental practices and implement them are called green institutional entrepreneurs. Therefore, the recognition of the green institutional entrepreneurs is necessary when implementing green strategies and changing institutionalized practices. In this article, the process of change in PEAB, Construction Company, is scrutinized by the notion of institutional entrepreneurs and its involvement to motivate and perform as a role model. Furthermore, actors and their role classification is carried out based on their involvement during a change process. Findings illustrate some situations where actors can be recognized as green institutional entrepreneurs and might help to implement green strategies. Moreover, Findings illustrate the indispensability of human agency and social interaction connected with the socio-emotional interactions carried out during day-to-day practices. Finally, findings highlight the correlation between achieving a green change and building a green competence is highly connected to the human agency interaction.*

**KEYWORDS:** Institutional entrepreneurs, Human agency, Green change, Swedish Construction Sector.

## INTRODUCTION

Over the last decade, there has been growing pressure on western companies to become more aware of environmental issue. Leading forces such as green consumers, insurance companies and green investors demand companies to be aware of the strategic importance of environmental issues (Azzone and Bertelè, 1994). Therefore, companies start to change in different ways to improve the environment. In fact, green change has been defined as “green” strategy. The competitive advantage is based on adapting environmental methods as a key for being sustainable (Olson, 2008). The outcome of this research is to provide information for illustrating situations where actors can be recognized as green institutional entrepreneurs and implement green strategies in PEAB (Swedish Construction Company). Consequently, the analysis is able to identify hierarchal positions and networks where Top Management should focus for developing green strategies. Finally, it presents possible means for institutional entrepreneurs to use during on-going green change.

## INSTITUTIONAL ENTREPRENEURSHIP

DiMaggio (1988) introduced the concept of institutional entrepreneur as actors who come up with divergent change and actively implement these changes. The notion of institutional entrepreneurship is explained as activities of interested individuals on specific institutional structures having access to the resources to construct

new institutional structures or transforming the current ones (Raghu et al., 2007). They are embedded in organizations which the organizations also are embedded in organizational field. According to this model, two main factors are defined as enablers of institutional entrepreneurs’ human agency: 1) Field characteristics, and 2) Actors’ social position (Battilana et al., 2009).

Actors’ social position is used as the intermediary between actors’ relations and the environment which they are embedded. The actors’ social position is constrained by their position in their social groups (informal groups) and also by their position in their organization. Formal position in hierarchy structure and informal positions in the organizational networks will affect the willingness of the individuals to conduct divergent organizational change in their organizations or able to do so (Battilana, 2006)

Institutional entrepreneurs are change champions in organizations. They are agents who initiate divergent organizational changes, break the institutional status quo in a field of activity, and transform existing institutions or create new ones.

## A GREEN INSTITUTIONAL ENTREPRENEURSHIP CLASSIFICATION AND ANALYSIS

In this search actors in a possible position to change and/or defend current practices, were

classified in accordance with their implication of the human green agency.

The analysis is developed in accordance with the individuals' inter-organizational mobility (background) which means the tenure in their current position, their familiarity with the construction sector and if they were new-comers in PEAB. Social position refers to the hierarchical visibility and willingness to enclose their personal reasons to support or defend practices, connecting their social position with the access to sources. Finally, the analysis followed-up and evaluated the informal communication paths.

The outcome of the classification is a recognition of roles where institutional entrepreneurs can emerge. A human agency perspective allowed us to classify actors in four main groups: Formulators (F), Mediators (M), Executors (E) and Environmental Staff (ES). According to this classification, Institutional entrepreneurs based on their roles have two main duties to implementing a green change:

### 1- Overcoming resistance to change

The concept of *green change* can be complicated. In the process of change the critical point is to avoid judgments that previous practices were incorrect and blame responsible actors. Interviewees agreed that "*Solutions done today might not be correct in the future*". Instead, common understanding has to focus on the aspects that can be performed better and being aware that these practices in the future might be incorrect. For this reason, the Environmental Manager is interested in attracting the most committed people, educating them, and providing them with enough freedom for performing tasks.

### 2- Creating a common "sense"

According to the Business Plan Formulators and Environmental Staff both agreed that common understanding has to be built to avoid different meanings. Hence, environmental information has to be framed differently depending on organizational level. The environmental staff realized that they need different narratives to spread the environmental information.

Environmental supportive staff attempts to unfold the meaning of environmental issues on a personal perspective or choice. Finally, this common understanding does according to the Environmental Manager integrate social, economical and environmental implications during the all phases of a project.

### IMPLEMENTING A GREEN CHANGE

*Environmental staff* have to act as institutional entrepreneurs for divergent organizational change

by convincing institutional defenders who guard the exiting situation because of their benefit from present status (Battilana, 2009). The study has shown that institutional defenders act as filter to decrease the information and eliminate changed practices. Therefore, *Environmental staff* need to present visions that motivate defenders to modify the existing situation and practice.

The Environmental Staff has to develop a common vocabulary for different actors with different backgrounds, incentives, and environmental knowledge for the whole organization to explain the sustainability and environmental work aligning the Business and Project Plan goals. To achieve a complete green engagement in all organizational levels, a common vocabulary should be developed in order to "*achieve a common understanding for why things are doing like this!*"

### CONCLUSION

As a result, the Environmental Staff needs to reach all organizational levels by connecting the socio-emotional interactions in the day-to-day practices for carrying out during environmental work. A change of mindset is required for walking on the sustainability path. For PEAB the journey to sustainability is taken as an engagement with a shared responsibility. Focusing on the actors who act as filters a change of mindset from "*an unknown responsibility towards a shared responsibility*" is required based on employees' reflection of "*what is my contribution?*"

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# UNETHICAL BUSINESS PRACTICES AND CORRUPTION IN INTERNATIONAL CONSTRUCTION: A SURVEY OF AMERICAN CONTRACTORS WORKING OVERSEAS

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*Transparency International has identified public works and construction to be the most corrupt industry sector in the world. It is estimated that up to 10 percent of the global spending on construction is lost to all forms of corruption. Unethical business practices and corruption in international construction has resulted in notable human and financial losses; and destruction of the environment. The purpose of this study is to analyse perceptions of American construction companies about unethical business practices and corruption in international construction. Necessary data was collected via a questionnaire survey. The results indicated that bid shopping, procurement of substandard/defective materials, bribery, and employment of illegal workers are the most prevalent ethics issues in international construction. Cultural practices, political systems, and social norms are found to be the biggest contributors behind these problems. About half of the survey participants were of the opinion that unethical business practices and corruption have slightly decreased during the last five years due to following of strict codes of ethics by many large international contractors.*

**KEYWORDS:** Ethics, Corruption, Professional practice, International construction

## INTRODUCTION

The public works and construction sector has been identified as the most corrupt in the world (Transparency International, 2008). The global construction industry is worth around US\$4 trillion per year. This represents 5-7% of the GDP in developed countries, and around 2-3% of the GDP in developing countries. It is estimated that up to 10 percent of the global spending on construction is lost to all forms of corruption. This estimate puts the total cost of global corruption and unethical conduct to about US\$400 billion per year (Usmen et al., 2009).

Published literature has indicated presence of unethical conduct and corruption across the world. For example, the Fails Management Institute (FMI) conducted a study for the Construction Management Association of America (CMAA) entitled "Survey of Construction Industry Ethical Practices" (Fails Management Institute, 2004). The study focused on the activities of construction project owners, architects, engineers, construction managers, general contractors, and subcontractors. The results were quite alarming. For instance, when respondents were asked whether they had personally experienced, encountered, or observed industry-related acts or transactions that they would consider unethical in the last 12 months, an overwhelming 84 percent said "yes". In addition, 34 percent indicated that they had encountered such acts "many times". A majority (63 percent) of survey respondents felt that the construction industry was tainted by the prevalence of unethical

acts. Similarly, 61 percent of the respondents thought unethical behaviour was affecting the cost of completing the projects.

The Chartered Institute of Building (2006) conducted a survey to gather views on corruption within the UK construction industry. It was found that there was a great deal of variation in the way that respondents perceived the nature and extent of corruption. It was acknowledged, however, that 41% of those surveyed had been offered a bribe on at least one occasion.

Hartley (2009) reported that within the Australian construction industry, anti-competitive practices especially related to workplace practices are common. These practices have included collusive bidding, lack of honesty and fairness in business relationships, and poor or non-existent occupational health and safety practices.

## PURPOSE AND SCOPE OF STUDY

The purpose of this study is to analyse perceptions of American construction companies about unethical business practices and corruption in international construction. The research objectives are: (1) to determine different forms of unethical and corrupt practices in international construction; (2) to subjectively explore magnitude of unethical and corrupt practices; and (3) to identify possible measures and remedies to combat corruption. The research scope was limited to large U.S. international general contractors.

## METHODOLOGY

A questionnaire was developed to collect the necessary data. A list of top 225 international contractors was obtained from the Engineering News Record (ENR) magazine. There were 40 American companies in this list which were selected for the survey. The questionnaire was compiled and distributed via a web-based service Zoomerang®. The data was collected between April 23, 2010 to July 6, 2010. There were 30 complete and 7 partial responses. Partial responses were excluded to maintain consistency in the reported results. Hence the final response rate was 75%. In the following sections, the brief results are reported whereas more details can be found in Selph (2010).

## RESULTS

The questionnaire was mainly responded by Vice Presidents (22%), Project Managers (26%), Procurement Managers (22%) and Overseas Operations Managers (11%). Out of 30 responding companies, 13 (44%) have worked on more than 10 international mega construction projects whereas 8 companies (26%) have completed 5 or more mega projects. The projects were located in Europe (35%), Asia (31%), South America (16%), Africa (10%) and Australia (8%).

The participants were asked to rate various unethical and corrupt business practices based on their experience, observations and gut feelings. Most respondents indicated *Bid shopping* as the most prevalent unethical practice followed by *Procurement of substandard/defective materials*, *Employment of illegal workers* and *bribery*. They mentioned that that *Cultural practices*; *Political systems*; and *Social norms* are the three biggest contributors for various unethical conducts.

The survey respondents were asked if they believe unethical business practices and corruption result in a significant cost to their company. The overwhelming majority (over 75%) said "Yes". Respondents were then asked approximately how much they believed these practices cost their companies every year as a percent of annual revenues. The responses were 1-3% (22%); 3-5% (33%); 5-7% (28%); and 8-10% (17%). On average, it is 5 percent of annual revenues. Since the annual revenue of the majority of companies was over \$1 Billion, it points a loss of approximately US\$50 million per year per company.

The majority of respondents believed there was either no change (48%) or a minor decrease (44%) in the magnitude of corruption during the last 5 years, which is a positive sign.

## CONCLUDING REMARKS

It is apparent that the unethical conducts and corruption is one of the most significant challenge currently faced by the construction industry. Approximately US\$400 billion per year is lost globally due to unethical business practices and corruption in the construction sector. A survey of top American contractors working on international projects revealed that the efforts to stop corruption are making headway but still there is a long way ahead. As shown in the survey results, the three biggest contributors to corruption are cultural practices, social norms, and political systems. Cultural and social norms vary from region to region and country to country. What might be considered unethical at one place might be a standard business practice in a different locale. When these different beliefs and practices collide, each party views each transaction from their own system of beliefs and standard practices. If one could get all parties to agree on a standard set of rules, it might help to level the playing field. Unethical business practices and corruption will continue to be an issue for years to come, but if owners and contractors will continue to commit to an ethical code of conduct, there would be a significant decrease in their level.

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# SENSEMAKING OF CORPORATE CULTURAL VALUES

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*This paper sets out to explore how an organisation guides their employees towards making the same sense out of the organisation's core values, in order to develop a common frame of meaning. This kind of framework helps the employees work as a single entity, rather than as a group of individuals, striving towards the corporate goals. It draws on a study conducted on a Swedish construction company, pseudonym: TOM. This company has developed a framework that encompasses their key values, known as the DDPR framework. The purpose of this study was to find out to what extent a framework like this can be made to permeate throughout an organisation and how individual employees work with it. The results show that core values can be a part of a company's trade mark and that they can be a valuable tool that helps shape the company on all levels. This can in turn create a strong image of the organisation both internally and externally and facilitate the work towards a mutual goal.*

**KEYWORDS:** basic assumptions, core values, corporate culture, sensemaking.

## INTRODUCTION

In corporate organisations it has become important to create an image for the organisation which reflects its goals and visions. This gives the organisation character and unique properties, creating a common frame of meaning. The purpose is to try to differentiate themselves from others and present their way of working to the world. For this to be possible, it is vital that the employees make the same understanding out of the organisational stimuli. For such an image to be persistent, all employees have to agree and correspond to the organisation's view, strategic goals and way of working. A way often used by organisations today is the implementation of keywords that frame these aspects, coming across as a single entity rather than a group of individuals, and then spreading their coherent identity not only to their external clients but also towards their colleagues within the company itself. (Clegg, Kornberger & Pitsis, 2008)

Looking to the construction industry and the majority of project organisations within it, Klakegg (2009, pp. 191) recognises that the governance of projects has become increasingly important during the last decade. He argues that to be able to integrate the different levels within such organisations there is a need for an institutional framework that spans over the whole organisation.

Hill, C. and Jones, G. (2008) define organisational culture as the specific collection of values and norms that control organisational interaction both internally and externally. This leads to the idea of

organisational values which they describe as beliefs and ideas about what goals members should pursue, and what behaviours are appropriate to achieve these goals. "From organizational values develop organizational norms, guidelines, or expectations that prescribe appropriate kinds of behavior by employees in particular situations and control the behavior of organizational members toward one another." (2008, pp. 394)

One of the largest construction companies in Sweden, here referred to as TOM, has made use of the technique of framing the organisation's culture. This is done by introducing four core values whose acronym makes up the name of the framework, the DDPR-framework. These values are: Down-to-earth, Developing, Personal and Reliable.

The main aim of this study is to explore how an organisation steers their employees towards making the same sense out of the organisation's core values and how the management use this to develop a strong corporate culture. The two research questions posed for this paper are: How can core values be made to permeate throughout an organisation's structure? Do core values affect the way an individual employee conducts his/her work in a large construction company?

## THEORETICAL FRAMEWORK

The theoretical frame of reference is the starting point of this paper. First the concept of core values is described as an instrument for making members of an organisation work towards a mutual goal. This is followed by an overview of the theories on

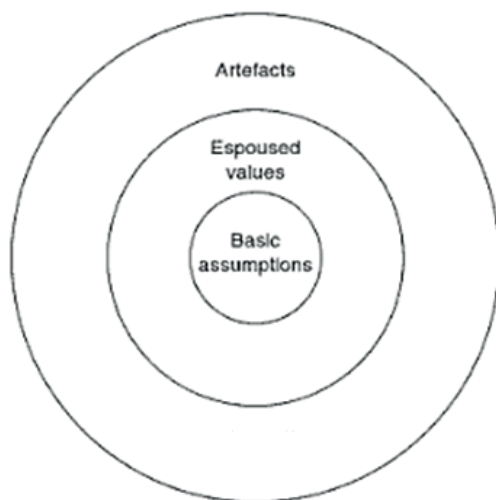


sensemaking and sensegiving which is crucial for the understanding of how core values are implemented.

Sensemaking is part of the foundation that core values rely upon. It is a process that rationalise what people perceive. This is not necessarily equal to individuals sharing the same understanding. However, to be sure that the employees do not choose different paths, companies can use sensegiving as a solution. With sensegiving organisations frame the elements which are important to them while other elements are kept in the dark. (Fiss & Zajac, 2006)

After the employees have interpreted the core values with the help of sensemaking, the next stage is to make sure they become a part of the organisational culture. Schein defines three levels of organisational culture. It is desirable for organisations to have core values integrated into the deepest of these three levels; the basic assumptions (see figure 1). (Clegg et al, 2008)

Figure 1: Schein's model shows three levels of culture where the deepest level is the basic assumptions that can be described as fundamental norms. Source: Clegg et al. (2008)



## THE CASE

The theoretical framework is followed by a presentation of the case. This includes a short historical background of the company TOM and a description of the four core values in the DDPR-framework. The case has served as the empirical ground for examining the concept of core values in a practical context.

During the last decade, TOM has developed and implemented a framework that describes the company's corporate values. As mentioned earlier, the framework is known by its acronym: DDPR, the letters standing for Down-to earth, Developing,

Personal and Reliable. This framework was developed from a survey conducted, where all employees and customers got to answer what they associated the company with.

## CONCLUSIONS

Core values can be a part of a company's trade mark and it has been shown that they can be an important piece in the relationship to actors both within and outside the organisation. The framework serves as a tool that helps shape the company on all levels. Therefore a strategic choice of core values is to choose such that people can relate to through their own basic assumptions. If this is achieved, the result can be both a strong coherent image of the organisation as well as a governed way of working.

The study indicates that there could be a correlation between these and corporate identity. However, the concept of core values is wide and therefore further research is necessary to provide any substantial conclusions.

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# THE STUDY OF A KITCHEN ASSEMBLY PROCESS IN INDUSTRIALIZED HOUSING

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*The kitchen is the heart of the house where people spend much of their time. It is, therefore, an important room that requires high quality. Because construction is argued to be unproductive and wasteful with low quality, studying a kitchen assemblage in detail is of particular interest due to its complexity with many details. In lean, the visualization and transparency of processes is the core for waste reduction and improvement. Low productivity levels are often argued to depend on a lack of information about the root causes of process problems. Thus, more information about the installation process of kitchens by studying the process is needed to target the sources of problems in terms of waste. The purpose of this paper is to gain a further understanding of how value stream mapping can identify different types of waste that occur when acquiring and installing kitchens. Value stream mapping is carried out through observations and interviews at an industrialized timber house manufacturer. Data analysis resulted in information about inconsistencies in the kitchen installation process, i.e. the root causes of costs and delays for the entire housing project.*

**KEYWORDS:** industrialized housing, waste, kitchen assembly, value stream mapping

## INTRODUCTION

The housing construction industry in the West has long been accused of being wasteful and underperforming, where quality is often poor and the building times are long and costly with endless corrections to defects after completion (Latham, 1994; Egan, 1998; London & Kenley, 2001; Briscoe et al., 2004).

Houses are “unique products of art” (Bertelsen, 2004, p.51) with an undocumented and complex production process (Gidado, 1996; Winch, 1998), considered as craft production (Barlow, 1999). The procedure of installing kitchen cabinets is a particularly complex assemblage with its many details. The purpose of this paper is to gain a further understanding of how value stream mapping can be used to identify different types of waste that occur when acquiring and installing kitchens, see Figure 1.

Figure 1: Kitchen installation in a volume element



## METHOD

A critical case study (Flyvbjerg, 2006) was chosen as an example of a housing factory that has emerged towards becoming a lean enterprise and thus a model for other house builders. The factory builds multi-storey timber houses through the construction of volume elements. In lean, value is determined by what the customer is willing to pay for, what Ohno (1988) defines as “real work”, the rest is waste. Therefore, all waste must be banished to maximize value. Rother & Shook (2003) argue that value stream mapping is an excellent tool to identify waste. The craftsmen installing the kitchen cabinets were observed for three months. During this time, all the steps in the kitchen assembly process, from delivery of the cabinets to assembled kitchens leaving the shop floor, were identified. The different steps were then analysed to target the seven wastes of Ohno (1988): (1) Overproduction, (2) Defect products, (3) Unnecessary movements, (4) Waiting, (5) Unnecessary transports, (6) Excessive stock and (7) Unnecessary processes.

## CONCLUSIONS

Value stream mapping with detailed observations of the product flow through the factory is valuable for detecting waste. By writing down the process on paper, the process is visual for discussion. Otherwise, undocumented processes can be interpreted differently by different people in the organisation. Hence, management may not be aware of the problems that cause waste and costs in a process on the shop floor might not be detected. To systematically follow a process is lengthy, though a deeper knowledge is obtained than

assuming the character of the value stream through second-hand descriptions.

In this study, waste occurred mainly in terms of defect products, e.g. the products were unfinished when leaving the factory. Ohno (1988) saw this as the worst waste when studying Ford. It becomes rather expensive to fix all the completions afterwards. The roots of the problems were inadequate drawings and customers not making choices on-time. Through enforcing choices to be made on-time and avoiding cabinet being placed on borders between the volume elements, the kitchens can all be completed in the factory. This saves a lot of money in extra work and transports to the final location of the house.

The inaccurate sizes of the volume elements require an extensive amount of sawing when installing the kitchen cabinets. By placing the saw closer to the carpenter or working on improving the accurateness in size of the volume elements, the waste in form of unnecessary movements can be eliminated.

Since there is a problem with unclear drawings, standardizing and documentation of “best practise procedure” of installation with improved drawings and proper work instructions can make the installation process more efficient. Hence, instant comprehension in how to proceed with the next task can be achieved and waste in terms of waiting is eliminated.

There is waste in terms of unnecessary transports inside the factory. When the cabinets arrive, they should be placed at a given place until it is time for installation. This prevents damages and waste in terms of rework when moving them around the factory.

The semi-finished kitchens could be finished faster to prevent bottlenecks if a signal system is installed to signal downstream workers to prioritize the most critical work tasks. This prevents waste in terms of excessive stock and delays in the process.

If all the workers do self-check of their own tasks and report errors of their own work, the quality control could be eliminated and inconsistencies in the process can be better visualized through everyone’s participation in improving the process and quality of the kitchens.

It can be concluded that a detailed study of the production process is important for process improvement. Without a close study of the value stream in progress, there is a lack of understanding regarding wastes that become hidden costs in the process.

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# ENERGY ISSUES IN PUBLIC PRIVATE PARTNERSHIP

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*During the last ten years, there has been a growing tendency in most European countries to develop new procurement methods in the construction of assets needed to deliver public services. Public private partnership (PPP) is one of these new methods. In France, PPP was formalised with a law enacted in 2004. PPP is supposed to bring better value for money for the public authority. The presentation highlights how PPP were assessed regarding time and cost performance, innovation and service quality. Then it examines how energy performance is taken into account and why stakeholders have not proposed innovative solutions to save energy in this kind of contractual agreement. The results indicate that energy issues are actually taken into account in French PPP projects mainly under the influence of building regulations.*

**KEYWORDS:** Public private partnership, energy saving performance contract, innovation, energy, procurement process

## INTRODUCTION

For the last ten years, there has been a growing tendency in most European countries to develop new procurement methods in the construction of assets needed to deliver public services. Public private partnership (PPP) is one of these new methods. It is a shift from conventional procurement process. Under this new scheme, design, build, finance and operation are transferred to private sector partners.

PPP is supposed to bring better value for money for the public authority. Thus the paper first presents a brief overview of the studies which tried to evaluate PPP on criteria such as respect of time and costs, innovation and service quality. Then it examines how the energy issues were taken into account in PPP projects.

## PPP AS PERFORMANCE BASED PRODUCT

### Respect of timetable and contracted price

The respect of time and the respect of costs are probably the issues the most examined in the literature. Most empirical studies indicate that cost overruns are more pronounced for traditional procurements than for PPP because incentives (penalties) are also smaller when the expected delivery time is not respected (Yuan and al., 2009). The time analysis is not always conclusive since PPP projects are more complex (Raisbeck and al., 2010).

### Innovation in PPP

PPP projects are also frequently portrayed as more innovative. However it appears that the regulatory framework is so strong in construction that it affects innovation by reducing design freedom (Leiringer, 2006). Public authorities are also frequently too prescriptive (Barlow and Köberle-Gaiser, 2008).

Moreover investors and financiers are risk averse and they have no incentive to encourage the implementation of innovative solutions since they support the risks associated to these solutions but not the benefits (Rintala, 2005).

## Quality of service delivery in PPP

Studies focusing on the quality of services show that contracts are often too vague (Robinson and Scott, 2009). The lack of sufficient precision does not allow covering all service delivery contingencies. This leads to disputes over interpretations of contracts. Penalties are also not motivating. Sometimes they do not compensate for the service disruption. In most cases it is also difficult to judge the quality of services delivery since subjectivity and incompleteness of contracts are frequent in this project. Moreover the renegotiation of contractual details to get better services after the signature of the contract is difficult because it requires the approval of many actors (for example the investors). Once the contract is signed the bargaining position of the public user is limited.

## ENERGY PERFORMANCE AND PPP PROJECTS

### The energy issue in two PFI projects (UK)

A literature review indicates how this issue was neglected. Only Rintala (2005) in its doctoral work tackled the subject by analysing two case studies in the UK. The energy price is always fully retained by the public actor since no private actor is able to control the market price of energy.

In one case the public actor retained the energy consumption risks because the private partner would have been unable to control the volume of the activity of the public actor. In a second case the energy consumption risk was shared. The private



actor was responsible for energy consumption above a certain standard. However the baseline for energy consumption was not very ambitious because both parties were not able to rely on historical data they could trust. In both cases, the operator had less influence on the service provision solution than the contractor. Consequently operational solutions were not optimised.

### The energy issue in French PPP projects

The energy issue was seldom raised in the first French PPP projects. Between December 2004 and the end of 2007, among the 114 projects that were either in procurement or signed, only 7 could be classified in the category “building and energy” (6%). Between 2008 and July 2010, 54 over 255 projects belonged to this category. This change was mainly due to new stringent building regulations and the “Grenelle de l'Environnement”, a national multi-party debate on environmental issues, involving bodies such as the government, local authorities, employers, unions and environmental associations.

Among the projects focusing on energy issues, energy saving performance contract (ESPC) benefits from a strong interest of municipalities. Indeed they have a department working on the energy issue which gathers reliable data on energy consumption of municipal buildings and on the usages.

The lack of projects focusing on energy from 2004 to 2007 was due to several factors (Bougrain, 2010):

1. Before 2008 and the new regulation most public actors did not include environmental issues and energy consumption risks in the output specification.
2. The energy issue is just one issue among many other. The service quality delivered to the patients is often the key points of the contract.
3. Most public authorities do not know the level of energy consumptions of their buildings in operation. Without data it is difficult to negotiate with a private partner.
4. Most of the issues dealing with energy are new. For example the general framework concerning the use of ESPC is still under development. Similarly performance based contracts are not widespread in traditional public procurement.
5. Most public actors wanted to integrate work on the building envelop in ESPC. But this tendency makes the contracts more complex and lengthens the return on investment. Thus contract needs to be signed for a longer period. It increases transaction costs and projects risks.

6. Almost no service company has competences to propose works that integrates the envelop and the systems.
7. The lack of data on whole life cost does not allow environmental comparison of buildings and tend to discourage the implementation of energy efficient solutions.
8. In private consortia, facility managers and contractors do not really cooperate since they belong to different business units whose aim is to increase their yearly profit.

### CONCLUSIONS

PPP projects have also to be judged on the long run. The integration of energy issues in the contract is one thing but its implementation is a different matter. The performance of PPP in operation has rarely been treated and should be examined. It would also be interesting to examine whether the energy ambition in PPP project is similar in construction projects following traditional procurement models. The role of the users of the buildings would also deserve further empirical investigations since human behaviour has a strong impact on energy consumptions of buildings.

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# CRAFTING COMPETENCES: THE FUTURE OF THE SKILLED WORKER IN DENMARK

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*The Danish and Global construction industry undergo continual change in use of materials, equipment and methods. The aim is to demonstrate how these new tendencies in material and immaterial demands impose change in production and work processes in the construction industry, hence calling for new and different definitions of competences compared to traditional bounded skills. The study also intends to illustrate the appearance of new patterns in professional interaction amongst construction workers and interaction between construction workers and customers. Drawing on recent concepts of competence such as OECDs the paper distinguish between non-production-related process skills and production dependent component skills. Case studies shows how new market and political demands inflicts on the organization of work and challenge the competencies embedded in and associated with traditional crafts. The methods used are explorative interviews and field observations. It is concluded that specific processes of change concerning material and immaterial demands, requires a rethinking of necessary skills and competences to succeed as a construction worker in a field undergoing rapid change. Given the Danish occupational training structure, there are political options for response with further educational development to the industrial trends.*

**KEYWORDS:** Construction industry, development of competences, material/immaterial demands

## INTRODUCTION

The construction industry is currently characterised by complexity and diversity. The construction workers are faced with new and shifting demands and are operating in contexts undergoing change. The development of competences of the construction workers often has the respective crafts as a starting point. The purpose of this paper is to investigate how the competences of the construction workers are challenged by changes in material and immaterial demands and wishes. Furthermore it is the aim to discuss a rethinking and definition of the construction workers necessary competences. What are the challenges facing the construction workers when it comes to competency? Is core professionalism challenged? Are the cores of the crafts challenged or irrelevant or does different crafts need rethinking, redefinition and supplements? Does professionalism has to be redefined? The purpose of the paper is to present different cases and scenarios and discuss different aspects of competence thinking in the construction industry.

The paper draws on empirical knowledge of construction work and the resulting current and future skills needs. Based on an analysis of building production and competence, using OECD competence concepts it will be possible to strengthen the construction workers competences through a targeted and appropriate training strategy. In addition we consider a more relational and contextual concept of competence based on Brammings approach (2001). Further studies could create a well-documented and useful tool for use in

the development of the vocational training both basic and further education.

The paper will deal with corporate and construction workers competence relationships of two areas which we will define as the *process competence* and *component competence*.

## METHOD

This paper is partly drawing empirically on two studies initiated by Byggeriets Uddannelser (a secretariat housing the trade committees of building and construction and The Vocational Training Committee for Building, Construction and Industry) and carried out by Byggeriets Uddannelser and Byggeriets Uddannelser and The Danish Technological Institute 2009. The studies have had different purposes but are in different ways preoccupied by development of competences in the construction industry.

## CASES

The cases shows the diversity and complexity of the building and construction industry. The cases deals in particular with 1) immaterial requirements and values relation to construction products and production, 2) standards, monitoring, evaluation and management.

## DISCUSSION

The complexity and diversity derives from new, shifting and different organizational, political, material and immaterial demands of building and construction products. The construction workers are thus operating in contexts undergoing change.

The current core of the construction workers professionalism is often The Craft. We argue that the challenges facing the construction workers when it comes to competency comprises of more than the development of The Craft. We also argue that a rethinking and definition of the construction workers necessary competences carefully must consider in which changing contexts construction workers act. Hence we suggest an expanded concept of competence to be able to comprehend the needs for development of the crafts, skills and the professionalism. We find this approach necessary in any efforts to rethink or redefine professionalism and supplements to the crafts.

We have mentioned assembly as common in certain areas in contrast to crafting competences. This could be perceived as a development of de-qualification of the construction worker. On the contrary we argue that the necessary fields of process and component competences are expanding. This suggests that the crafts, skills and different professions must develop accordingly. As shown there are several new and different markers of competence in almost every context. Competences are redefined and created in the shifting contexts.

## CONCLUSIONS

We have considered a rethinking the development of competences by using a broader concept of competence which can handle and relate to changing contexts. We argue that this is not a question of de-qualification, but that there could be a need for another perspective on competence than the respective crafts and professions as a starting point. As shown process and element competence is both developing fields that are constantly challenged and changed in various ways. Development of competences has to be regarded as more dynamic and able to accommodate rapid change and different requirements.

Market and policy requirements are affecting the organization of work and challenge the competences embedded in and associated with the crafts. The premise is that both process and component competences are being and must be constantly evaluated and that targeted and appropriate training strategy should be based on the competences related to practice. Returning to the definition of competences by OECD we argue that the identification of key competences and making them subject to individual development must be coupled with a more dynamic approach where competence is seen as relational in a given context, work situation and practice (Bramming, 2001).

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# QUANTITY CHOICE IN UNIT PRICE CONTRACT PROCUREMENTS

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*A common approach for procuring large construction projects is through Unit Price Contracts. By the means of a simple model, we study the optimal quantity to procure under uncertainty regarding the actual required quantity given that the procurer strives to minimize expected total costs. The model shows that the quantity to procure in optimum follows from a trade-off between the risk of having to pay for more units than actually necessary and of having to conduct costly renegotiations. The optimal quantity increases in costs associated with possible renegotiations, decreases in expected per unit price, and, if a renegotiation does not increase per unit price too much, decreases in the uncertainty surrounding the actual quantity required.*

**KEYWORDS:** Unit price contracts; procurement; construction

## INTRODUCTION

Large constructions, e.g., infrastructure projects, may be procured in a series of different ways. In many countries, the prevailing approach in practice seems to be through Unit Price Contracts (UPC). In a UPC, the procurer, e.g. a national road administrator, specifies the amounts of each activity, e.g., the amount of gravel to be removed, and lets the agents bid on unit prices. Typically, the agent with the lowest total bid – summing over all amounts times the bidding prices – wins the procurement.

This paper addresses the optimal behavior of the procurer, henceforth the principal, in UPC procurements. In particular, it addresses what amount of an activity to procure in a setting where the actual amount required is uncertain. Previous work dealing with UPC more or less implicitly assumes that the principal will procure the estimated amount of each activity. For instance, Ewerhart and Fiesler (2003) states that in a UPC “the buyer estimates the quantities of the respective input factors that will be needed to accomplish the task. Then the buyer publicly announces her estimates [...]”. We will, by the means of a simple model, show that this notion is not correct. Rather, there are cases in which the principal should – in order to minimize her expected total costs – procure a quantity exceeding the estimated or expected one and other cases in which the procured quantity should be lower. More importantly, the model will provide us with an intuitive understanding for the mechanisms at work.

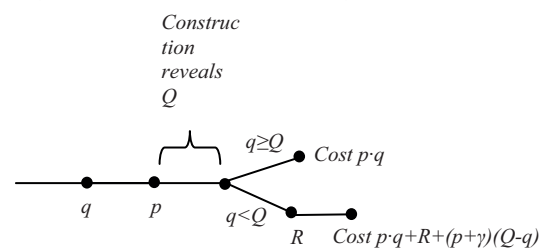
The paper is structured as follows: The first section introduces the model and leads up to a first-order condition. The characteristics of this condition is analysed in section 3. The model relies on a series

of assumption. Possible consequences of relaxing some of the more restrictive assumptions are discussed in section 4. Section 5 concludes.

## The model

The model is described below. In the first stage, the principal decides on how many units to procure,  $q$ . This is followed by the procurement, which will establish the winning per unit price,  $p$ . We assume that  $p$  is uniform distributed between  $p_{low}$  and  $p_{high}$ . The next step is the construction phase under which the true  $Q$  will be revealed to the agent. We assume that  $Q$  is uniform distributed between  $Q_{low}$  and  $Q_{high}$ . If  $q$  is sufficient, i.e.,  $q \geq Q$ , payments are made according to the contract and the game ends. If not, renegotiations (R) are needed which will lead to renegotiation costs. The remaining construction ( $Q-q$ ) will be executed at the new price ( $p+\gamma$ ).

Figure 1. The sequence of the game.

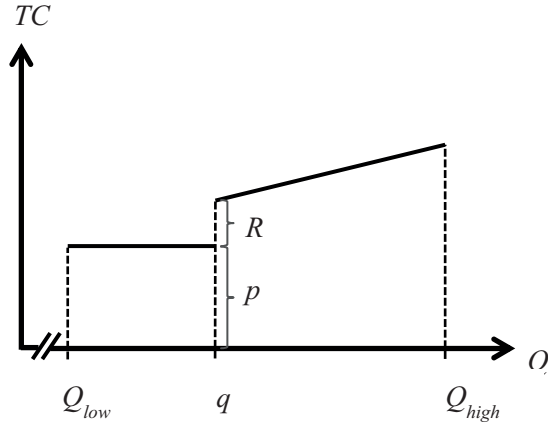


Using the assumptions above, the principal's total cost,  $TC$ , will be

$$TC = \begin{cases} p \cdot q & \text{when } q \geq Q \\ (p \cdot q) + R + (p + \gamma)(Q - q) & \text{when } q < Q \end{cases}$$

One key factor is that for realizations below  $q$ ;  $TC$  always equals  $p \cdot q$ . The principal thus, most likely, pays for  $q$  units even though the project could have been carried through using only  $Q < q$  units. Note that for these realizations; the principal only knows that  $Q$  is weakly less than  $q$  as he may not observe  $Q$ . The other key factor is the cost of renegotiations. In figure 2 these costs show up in two different ways; first through a shift in the  $TC$ -curve at  $q$ , due to the renegotiation cost, and, second, through the slope of the  $TC$ -curve above  $q$ . If there is a mark-up in per unit price due to the renegotiation, this will result in a steeper  $TC$ -curve.

Figure 2. Total cost over realization of  $Q$ .



Neither party knows the actual  $TC$  prior to the construction phase. Rather, the principal strives to minimize the *expected* total cost.

$$E\{TC\} = \frac{1}{p_{high} - p_{low}} \int_{p_{low}}^{p_{high}} \left( \frac{1}{Q_{high} - Q_{low}} \left( \int_{Q_{low}}^q p q dq + \int_q^{Q_{high}} (p q + R) dq + (p + \gamma)(Q - q) dq \right) \right) dp$$

By optimizing this equation and solving the first order condition it is possible to analyze how each parameter influence the behavior of the principal.

### Analysis

The principal's optimization problem amounts to choosing  $q$  to minimize  $E\{TC\}$ . We derive the following first order condition

$$q^* = \frac{\bar{p} Q_{low} + \gamma Q_{high} + R}{\bar{p} + \gamma}$$

We are now interested in how optimum choice of the principal,  $q^*$ , changes as the exogenous parameters changes. Therefore we differentiate the above equation with respect to each parameter.

Differentiating with respect to  $R$  yields:

$$\frac{\partial q^*}{\partial R} = \frac{1}{\bar{p} + \gamma} > 0$$

and with respect to the price mark-up,  $\gamma$ , yields

$$\frac{\partial q^*}{\partial \gamma} = \frac{\bar{p}(Q_{high} - Q_{low}) - R}{(\bar{p} + \gamma)^2} > 0$$

They are both positive. Thus, if the renegotiation price or the mark-up price increases, the principal increases the contracted quantity and thereby reduces the risk of having to pay for the higher renegotiation cost or the higher renegotiated price. If the expected per unit price increases, the principal will reduce the procured quantity, as seen from differentiating with respect to  $\bar{p}$  which yields

$$\frac{\partial q^*}{\partial \bar{p}} = -\frac{R + (Q_{high} - Q_{low})\gamma}{(\bar{p} + \gamma)^2} < 0$$

the principal will reduce the procured quantity as a renegotiation has become relatively (but not absolutely) less costly.

In the paper we also analyze how the optimal quantity to procure depends, in addition to the variables discussed above, on the lower and upper limit of the distribution of  $Q$ . In other words, if the lower and upper limit increases the uncertainty of the outcome for  $Q$  increases. There is no clear answer how this effects the optimal procurement.

### CONCLUSIONS

The model shows that the optimal quantity to procure, i.e., the one that minimizes the procurer's expected total cost, is determined by a fundamental trade-off between (1) the risk of having to pay for more units than actually necessary and (2) the risk of having to conduct costly renegotiations. In optimum, the procured quantity will increase in costs associated with a possible renegotiation. It will decrease in the expected per unit price. Typically, if the renegotiation does not result in too large mark-up in per unit price, the procured quantity decreases in the uncertainty surrounding the actual quantity required. These results have all been shown mathematically and the intuition behind them is discussed in the main text.

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# DOES CONSTRUCTION PARTNERING RESEARCH REFLECT CHANGES IN SOCIETY?

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*Studies of partnering hold a strong position among researchers in construction management and exemplify a variety of scientific approaches. The purpose here is to analyse how leading contributions to construction partnering research have related the phenomenon to broader changes in society. Ten highly cited articles are selected, of which eight are clearly focused on partnering. Background societal themes or forces that can be identified in these articles are international competitiveness, the business cycle and information technologies, but these themes are hardly reflected in the research questions or the research design of these articles, which take a broad view of the field or collect practitioners' opinions. The explosion of interest in partnering after 1990 appears to have taken the researcher community by surprise. Chinese and Japanese influences, not from the construction sector, and partly transmitted through American publications, have been overlooked or underestimated, as well as the development of New Public Management. Thus those who have investigated construction partnering emerge as reactive and therefore unlikely to resolve tensions, ambiguities and paradoxes felt by leading practitioners in the construction sector. A conclusion is that new understanding, leading to new industry practice, should be based on approaches from disciplines that support prediction.*

**KEYWORDS:** partnering, competitiveness, China, Japan, New Public Management

## INTRODUCTION

Since the early 1990s, many researchers have studied how partnering practices have been developed and how these have spread in the construction industry. Work on partnering is central to the field and dominates citation patterns for scientific articles in construction management. However, it is seldom that the partnering phenomenon itself has been seen in a broader societal perspective. The partnering phenomenon offers an opportunity for closer study of the relation between construction management research and changes in society.

The adversarial relations in a fragmented construction sector were identified as a policy and a research problem already in the 1960s. What needs explaining is why it took more than twenty years before this led construction management researchers to explore alternative practices. The typical 1960s way to overcome lack of communication in projects was to refine and optimize the documents exchanged between contractual parties.

Against this background, the purpose here is to analyse how leading contributions to construction partnering research have related the phenomenon to broader changes in society.

## THE TEN ARTICLES

'Leading contributions' to construction partnering research are interpreted here as being frequently cited articles in international scientific journals, although this is an interpretation that can be questioned. Ten articles have been selected as being the

most frequently cited according to Google Scholar and Scopus in late 2010, containing the two words 'construction' and 'partnering' in the full text of the articles. This selection procedure reduces the need for establishing a general definition of 'construction partnering'. When the same author recurs among the top ranked, only the most cited article has been included. One article obviously falling outside the construction management field was eliminated initially. The resulting set of articles does not necessarily reflect the current status of partnering research, given that they were published between 1995 and 2003. The introduction and the conclusions of each article were analysed for their indications of background phenomena that the authors regarded as important.

## THE CONTEXTUAL THEMES

Reading the introductory parts of the articles, several contextual themes with elements of change recur. First, authors refer to themes that are internal to the construction industry; the main themes here are industry fragmentation, litigation, poor performance in terms of productivity or quality and also little or slow innovation. There are just a few themes characterized by dynamics and larger perspectives: one is growing international competition and another is increased project size and complexity, together with advances in information technology. A strongly dynamic theme, although seldom mentioned, is that of the business cycle and fluctuations in construction demand.



## NEGLECTED INFLUENCES? MAO AND NPM

Construction partnering has its origins in the private sector and as a set of practices, it preceded the US Construction Industry Institute (CII) Task Force that was active from 1987. Partnering soon migrated into construction projects with public clients. We encounter a nexus between Chinese influences and American business writing (Chan & Clegg, 2007), ultimately contributing to major changes in governmental policies in Western countries in general. The final CII report in 1991 was called *In Search of Partnering Excellence*, a title that in itself declares its link to the Peters and Waterman 1982 bestseller, *In Search of Excellence*. There is a Chinese influence here, but not Confucian. Textual parallels reveal echoes of the Cultural Revolution, and 'the masses' found in *Quotations of Chairman Mao* resurface as 'the customers'.

The shift of public clients into partnering is best explained as a feature of New Public Management, NPM. A convenient framework for understanding the links to partnering has been provided by Hood (1991) who has listed a number of doctrinal components of NPM: (1) hands-on professional management in the public sector, (2) explicit standards and measures of performance, (3) greater emphasis on output controls, (4) shift to disaggregation of units in the public sector, (5) shift to greater competition in the public sector, (6) stress on private-sector styles of management practice, and (7) stress on greater discipline and parsimony in resource use. Some of these components recur in partnering practices. NPM is both a change in society and a set of practices, some of which are replicated in partnering projects.

The Latham review was the first time that clients were formally involved in UK construction policy reform, and the "consumer movement had spread to construction" (Adamson & Pollington, 2006: 11). After this review, the Treasury wished to improve public client practices while private sector clients were more reluctant to engage. In the UK, the 'sovereign' customer became literally that in the guise of the public client. There was a fusion of customer-orientated thinking with government client power. One of the private industry trends, that of customer survey technologies, was also introduced or at least reinforced in construction by government action, along the lines of (2) and (6) above, although the employees to be controlled were now seen as the contractors working for government clients. The key performance indicators for construction launched in 1998 adapted a US system for measuring customer satisfaction with new homes, only replacing household customers with public and commercial clients.

However, the principle of introducing a 'market relation' was hardly the recipe for improving construction projects, which might already suffer from an excess of market disputes and would benefit from more elements of hierarchical relations. Thus another NPM principle, to 'replace hierarchical control with simulated market control', was irrelevant.

## CONCLUSIONS

Construction partnering research does reflect changes in society, but only indirectly. Background societal themes or forces that can be identified in the ten articles are international competitiveness, the business cycle and information technologies. Chinese and Japanese influences, not from the construction sector, have been overlooked or underestimated, as well as the development of New Public Management.

But this may not be typical of articles that have attracted fewer citations or are of more recent origin. The ten articles emanated from the Anglo-American legal sphere: from the US, the UK and Hong Kong with Australia, thus written by authors from policy-shaping regions. Industry, government and academic interest in partnering followed later in countries outside the common law tradition, including the Nordic region.

Ultimately, those who have investigated construction partnering emerge as reactive and therefore unlikely to resolve the tensions, ambiguities and paradoxes felt by leading practitioners in the construction sector. What should then be on the agenda for construction management researchers who wish to predict future changes in the industry—and support practitioners who look for deeper insights into the forces and mechanisms that produce change? New understanding, leading to new industry practice, could be based on approaches from disciplines with theories that support prediction, such as economics. And if it is argued that construction management research should forsake predicting the future, a case could be made for greater awareness of what political scientists do.

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# THE IMPORTANCE OF ACQUAINTANCES – KNOWLEDGE DIFFUSION IN THE CONSTRUCTION INDUSTRY

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*A forgetting-phenomenon seems to exist in the construction industry which causes that useful experience from the construction process to disappear after ended projects. For decades initiatives have been implemented in construction projects in order to develop the construction process, and participants' general impression of such projects has been that the initiatives were useful. Even so, experience from these projects has only left few marks on subsequent projects. This paper seeks an explanation of this phenomenon from the perspective of the skilled workers. They mostly appreciate tacit and practice embedded knowledge, and from this perspective experience diffuses through social settings, whereas the facilitation of knowledge diffusion is focused on explicit knowledge such as written evaluation reports. On the basis of qualitative case research, knowledge diffusion is analysed and unused potential for further facilitation of such is presented. Hence, the conclusion is that there is an unused potential for increased knowledge sharing in the social network among skilled workers in construction projects. There are though some barriers; among others the people involved are not familiar with knowledge exchange or sharing. Therefore, the diffusion of knowledge in the construction industry is so difficult.*

**KEYWORDS:** Construction process, knowledge diffusion, development, communities of practice, weak ties

## IT IS THOUGHT-PROVOKING

*"It is thought-provoking: This Company brands itself as innovative and professional regarding process management, and yet it handles the construction process very differently from region to region. When such a large company cannot diffuse its experience internally, it is not surprising that the industry keeps re-inventing the wheel during each project".*

The above is a quotation from a client and expresses his frustration when working with a nationwide contractor. What is the reason for the limited re-use of experience and knowledge in the construction industry?

This paper focuses on how to facilitate the knowledge of the skilled workers with the objective to support an incremental development of the construction industry. Focus is on the coordinating knowledge and the relation based knowledge used for transforming blueprints into constructions.

Based on findings from a case, the nature of knowledge used by the skilled workers is discussed, and strategies for knowledge diffusion are presented. Finally the challenges when working with knowledge diffusion are discussed with the objective to detect unused potential of the skilled workers as knowledge workers.

## METHODOLOGY

A case was monitored for more than three years where qualitative research methods were used to examine learning, knowledge diffusion, and development of the construction process with focus on the skilled workers. As a part of the case study formal and informal interviews were conducted with representatives from the client's organisation, the project manager and the skilled workers at the construction site. Furthermore, observations and action research were carried out in order to understand and support learning and knowledge diffusion activities at the site.

The case project was the third in a sequence of four construction projects. The client's idea was to use the same team of consultants, designers, contractors etc. for all projects.

## KNOWLEDGE DIFFUSION AT THE CONSTRUCTION SITE

Experience from the case showed great diversity in the way different crews learned and diffused knowledge.

Most of the crews could be considered communities of practice as they are close and stable groups which have an internal understanding of own practice. However, the earth workers were a bit different. Even though they knew each other

very well, they did not know with whom they were supposed to work the following day. Therefore, they accumulated their knowledge in narratives, which they repeated in order to share knowledge.

The concrete workers were a tight and closed community. They even arranged their own Christmas party as alternative to the one held by their company which also included other professions. Most of them were un-skilled in the sense that they had never attended formal training.

The carpenters had worked together for decades and were very close. They never attended supplementary training, but perceived the suppliers as a sufficient source of knowledge. "If the handbook is outdated, we just get a new one from the timber yard - for free!"

The installation crews also used formalised knowledge and it seemed like their crews were not as close as the others. The electricians were offered supplementary training in required disciplines according to their interests. However, they seldom had the time to attend, or the courses were cancelled because of too few participants. Instead, they got their knowledge from the project manager, who served as a broker of information between projects.

### **REASONS FOR LACK OF KNOWLEDGE DIFFUSION**

Crews at construction sites work as independent groups that almost never seek or get knowledge from outside. Some of the reason for this situation could be elements such as payment, time pressure, ignorance and tradition.

For example, a meeting was held with the purpose that the skilled workers should discuss the overall settings of the construction site. First, a formal presentation was made by a consultant who described the development initiatives at the site. The presentation was short and precise. Nevertheless, most of the skilled workers had crossed their arms and were laid back. Their body language was very informative: They did not appreciate this presentation. Afterwards no one referred to the presentation when asked about their outcome of the meeting. Secondly, a subject teacher from the local training centre initiated a debate around the tables about the working conditions at the site. Here, the workers sat on the front of the chair and were very active, and the debate leads to several changes at the site. Thirdly, a football coach told about team work and the composition of a winning team. Again, the workers were very interested, however, when asked afterwards they could not translate this talk to their

own practice, but they found it amusing to hear about the football players.

The example showed the importance of knowing the skilled workers' knowledge base and form of communication in order to get a successful return of facilitating knowledge diffusion.

### **UNUSED POTENTIAL FOR KNOWLEDGE SHARING**

Even though the methods for internal knowledge sharing varied in the different crews, all of them seemed to be successful with it. However, as the analysis showed, the knowledge diffusion across community boundaries was scarce, which can cause the crews to be fragmented and incoherent (Granovetter, 1983). The analysis also pointed out several unused methods for diffusing knowledge across boundaries, and facilitating these could lead to competitive advantages for the companies and increase development in the industry.

### **CONCLUSION**

The case showed that the crews internally are excellent in sharing knowledge, even though the methods used varies a lot. Contrary to this there seems to be no or little knowledge diffusion across boundaries of the crews.

The case also showed some unused potential for diffusing knowledge through social networks. However, it is all about keeping a balance between protecting the stable crews so they can keep being excellent knowledge sharing groups and on the other side connecting the different crews, in order for knowledge to diffuse and support incremental development of the industry.

The problem is double sided: first, the knowledge in play is embedded in practice in isolated crews. Secondly, the people involved are not familiar with knowledge exchange or sharing. Therefore, the diffusion of knowledge in the construction industry is so difficult.

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# RE-THINKING STAKEHOLDER MANAGEMENT IN CONSTRUCTION: THEORY & RESEARCH

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*From its roots in strategic management theory, stakeholder management has been adopted by the construction management academic community and applied as a valid paradigm around which research work has been generated aiming to improve project efficiencies and effectiveness. However, academics have argued that stakeholder management should move away from purely theoretical discussions and engage more with the realities of construction project work. This paper re-appraises the stakeholder management concept for the construction domain by re-thinking some of the fundamental principles and ideals present within the more general stakeholder theory literature. It engages with issues which researchers have arguably failed to acknowledge and calls for a re-evaluation of construction stakeholder management research by presenting a review around four distinctive themes: the moral obligations of engaging with stakeholders against the business and efficiency driven imperatives of construction organisations; the contrast between theoretical abstractions and empirically grounded research; the tensions between theoretical convergence versus calls for multiple and divergent perspectives on stakeholder management and the practicalities of conducting stakeholder management in the construction domain. Such a critical re-appraisal of stakeholder management thinking both generates new lines of enquiry and promises to help inform and shape current and future industry practice.*

**KEYWORDS:** stakeholders; stakeholder management; stakeholder theory; construction project stakeholders

## INTRODUCTION

This paper reviews and re-appraises research work in the construction stakeholder management field and proposes a re-assessment and re-positioning of academic enquiry due to discrepancies and questionable assumptions in the published literature. This is achieved through a review of stakeholder management theory itself and by a critique of the corpus of construction stakeholder management literature that has been published.

The paper proposes that further research work in the field of construction stakeholder management should address four distinctive areas identified in the paper as aspects of the discipline which lack a strong and firm evidential base. The themes are discussed in turn sequentially: how the moral obligations of construction companies may clash with their business imperatives; the tension between theoretical abstractions and empirically-grounded research in the field; the tendency towards theoretical convergence as opposed to divergent and multiple narratives and the practical implications of conducting stakeholder management in the construction domain.

### **Moral obligations versus business imperatives**

The construction stakeholder literature has failed to engage with the issue of how the moral obligations of organisations relate to their business-driven imperatives. Whilst the morality concept has been addressed by some researchers in the field (in more

theoretical terms than practical), the issue needs further applied research work in order to make the construction stakeholder management discipline more robust.

### **Theoretical abstractions & empirically-grounded research**

There is a tendency for academic research to use theoretical abstractions regarding stakeholder management rather than sound, empirically-grounded research findings. Devices such as “power-interest” matrices lack true empirical foundation and the concepts utilized are often vague. Such abstractions need to be strengthened through applied, empirical grounded research work in the field.

### **Theoretical convergence or divergent & multiple narratives?**

A temptation amongst academics is to attempt theoretical convergence in order to simplify a difficult and complex subject. This tendency is evident in the construction stakeholder management literature. More multiple and divergent narratives of construction stakeholder management need to take place in order to advance understanding of the issues involved.

### **Practical implications of conducting stakeholder management in construction domain**

The published academic literature often fails to address the very real questions concerning the

practicalities of conducting construction stakeholder management in the real world. Questions remain over such issues as the role of the project manager in stakeholder management, the practicalities of conducting stakeholder management activities and how it impacts upon other business activities of construction organisations. Such issues and questions need to be addressed if the discipline is to be rooted in the realities of construction project activity.

## **CONCLUSIONS**

The paper closes by repeating the call for a re-focusing of construction stakeholder management research activity to addresses the issues and themes outlined in the paper. Applied research work which engages with such themes will make the construction stakeholder management discipline more robust and mature as a result.



# DEVELOPING COLLABORATIVE CONTRACTING – THREE RAILWAY PROJECT CASES

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*Collaborative contracting models are often associated with a set of tools and techniques to manage relationships, but the efficiency of such formalization in changing project culture has been doubted. Further, although many projects are successful, collaboration often is more limited than policies and guidelines suggest. In this paper, we view partnering practice as a learning process related to a management innovation and analyse how collaboration practice develops in three major railway projects, all using the same partnering model. We find that partnering is easy to introduce due to the flexibility and adaptability of the concept, but that practitioners prefer to keep collaboration informal and groups small. Also, tangible benefits can often be reached with basic and common-sense approaches. When ambitions and complexity increase, however, more sophisticated relationship management becomes inevitable, calling also for integration with core project processes. Yet, partnering tools and systems do not seem to provide much guidance when it comes to organizing such complex multiparty collaboration. Findings suggest that shortcomings relating to organizational issues are underestimated as causes of conflicts and inefficiencies.*

KEYWORDS: partnering, trust, collaboration, infrastructure projects, railway construction

## INTRODUCTION

In the past years, there has been significant dissatisfaction with many Swedish infrastructure projects. Insufficient risk management has resulted in high cost overruns and lawsuits, impacting on contractors' interest in submitting bids for major projects with high risks. In 2003, an industry-wide collaborative initiative was established by major industry actors to promote efficiency and learning in the infrastructure sector, and a general model called Extended Collaboration (EC) has been developed to guide project managers. It has been questioned if more fundamental transformation can be brought about by a set of formal practices and systems (Bresnen and Marshall, 2002), and several authors have observed that partnering in practice often is more limited than the policies and guidelines envisage (Mason, 2007; Gadde and Dubois, 2010).

However, it may take time for organizations and individuals to adapt to and modify a new practice to a specific context, and partnering can also be seen as an emergent practice (Bresnen, 2009). In this paper, we describe the forms that collaboration practice take in projects and analyse the causes of similarities and variations as well as implications for future development. We view partnering practice as a learning process related to a management innovation: partnering guidelines provide sets of tools and techniques which project decision-makers interpret when they design and

negotiate an approach for the specific project. The resulting practice will reflect the formal model, but also managers' own practice-based understandings and preferences regarding what collaboration implies and requires in terms of management and communication. The discussion is based on a study of how the EC model is applied in three recent and ongoing railway projects.

## FRAME OF REFERENCE

There is a set of tools, procedures and characteristics generally associated with partnering. Bresnen and Marshall (2002) mention selection procedures, formal teambuilding exercises, appropriate financial incentive systems, formal integrative mechanisms (such as charters, dispute resolution procedures, teambuilding workshops and the use of facilitators), continuous improvement programmes and benchmarking as being typical partnering tools and techniques.

According to Ansari, Fiss and Zajac (2010) a practice that operates on an abstract level, has an interpretive viability and can lend itself to multiple interpretations has a greater likelihood of adaptation (but with greater variation and lower fidelity to the source model). Further, high divisibility, i.e. the degree to which an innovation may be experimented with at low cost (small trials), will facilitate adoption. Accordingly, adoption will be constrained if the innovation has a high complexity or is perceived as difficult to

understand. Initially, a new practice may then be partially adopted in a simple low cost version, to be further adapted to the specific context and perhaps also more sophisticated and costly with time (Ansari, Fiss and Zajac, 2010).

In the case of partnering, the combination of commonsense competencies such as “trust” and “collaboration” and a relatively simple toolbox with high divisibility means that the threshold for applying partnering should be low. However, the apparent simplicity may mask difficulties and complexities that will arise as the reality of interparty collaboration unfolds. For example, there is often a need to balance between different goals and management approaches (Huxham and Vangen, 2005; Koppenjan et al., 2010), and this problem increases with the number of participants.

## METHOD

Three rail construction contracts were selected for case studies. One project was in the middle of construction at the time of the study B, while the two others were more recently started. In each project, representatives from the client (Swedish Transport Administration), contractors and consultants were interviewed.

## RESULTS

The opinions of the collaboration were generally very favourable among those interviewed. In all three projects, collaboration was perceived as the only way to handle high complexity.

The EC guideline seems to have influenced mainly the organization forms (steering groups, cooperation groups, process leaders and conflict management systems). Workshops and target cost contracts were also used. In two projects, collaboration was less formalized and restricted to smaller groups. In the most complex project, however, extensive formalization and planning of both EC and design collaboration was seen as absolutely necessary to control the project. Communication between the subparts was carefully planned and formal meetings and evaluations were important.

## CONCLUSIONS

As a management innovation, partnering is clearly very flexible. It can be applied with very varying levels of ambition regarding depth and width, and the positive views indicate that basic and commonsense approaches may produce significant improvements. However, there are also tendencies that complexity is suppressed, thereby introducing relational risks. Still, a more complex collaboration that involves the design team, subcontractors or external actors is significantly more demanding, since it requires not only more partnering activities,

but that core project organizations and processes are designed and staffed to enable collaboration. Partnering tools and systems seem to be too general to be helpful in managing this totality of partnering processes and core project activities.

It is possible that the presence of low hanging fruits may prevent the spread of more sophisticated models except for in very complex projects. However, many of those interviewed proposed further improvements, for example including more participants and involving contractors earlier. Such seemingly minor changes may radically raise requirements for formalization and planning.

Most partnering literature tends to emphasize attitude problems, distrust and cultural change as main challenges in establishing collaboration. Our case studies, however, point at shortcomings in organizing collaboration as important sources of conflicts and inefficiencies.

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# SUSTAINABILITY IN THE BUILT ENVIRONMENT BY USING EMBEDDED TECHNOLOGY

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*Various studies have demonstrated that innovation of sustainable products and solutions in the built environment using embedded technology in constructions generates value both by reducing emissions of greenhouse gasses from buildings and by optimising comfort for the end-user. Based on a project on User-driven Innovation and Embedded Technology in Construction, this paper presents a number of potential products and solutions for sustainability. This covers a variety of areas such as recycling, energy efficiency. In addition, the paper addresses a new concept of sustainable products designated Open Built Source products (OBS), by applying two principles: compatibility and reuse of building products with embedded technology. The methods used in the User-driven Innovation are presented, with focus on user engagement, interest and acceptance of the ideas arising from the process. Sustainability is categorised in the three dimensions environmental, social and economic sustainability. In this paper a fourth sustainability field is introduced; Adoption of sustainability. User adoption of sustainable solutions is not only achieved by developing the solutions, the user also needs to adopt the solution, before it may be implemented in practise. Several barriers need to be taken into consideration, such as usability, functionality and value for the user, technology fear, cultural and social backgrounds. The paper presents a new approach for dealing with User-driven innovation as a mean for developing sustainable solutions. The methodology is analysed, exemplified by innovated products and show how sustainable solutions may be implemented much more efficiently, by applying this new approach.*

**KEYWORDS:** Userdriven innovation, embedded technology, sustainability, energy efficiency, recycling.

## INTRODUCTION

A new approach combining collaborative innovation with user-driven innovation is presented, analysed from the point of adoption of the end-user. As a basis, the approach will be developed using principles from recognised methods of technology acceptance e.g. the TRA (Theory of Reasoned Action) and TAM (Technology Acceptance Model) models, keeping the focus on the effect of the interaction between the users and developers in the development of sustainable solution.

In the process of innovating sustainable solutions, there are several barriers to be taken into account, if the solutions are to meet the users' needs, be accepted and realized. Examples are privacy and lack of experience of the new technology.

It will be shown that given the right condition and surroundings, and with the rightly chosen users, collaborative innovation combined with user-driven innovation is a useful approach for developing sustainable solutions.

## THEORETICAL APPROACH

Adoption of new technology developments depends on various factors. More detailed reading is given in (Dillon, 2001). In this Paper we will assume that the most important personal factors

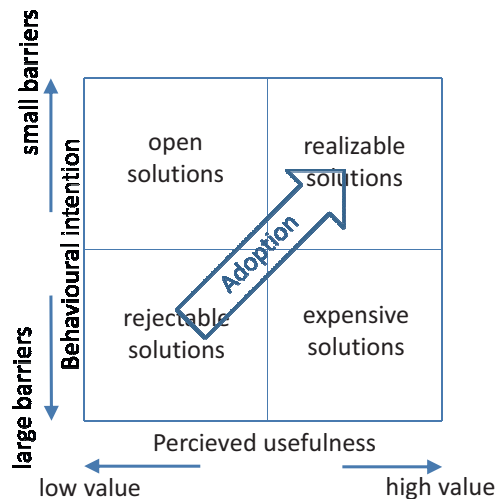
when dealing with high sustainable advanced technologic solutions are: Cultural and social background, Privacy, Technology fear and the corresponding most influencing technical characteristics are: Relative advantage and Compatibility.

Compatibility means that the solutions are consistent with social practice and norms among the users. These factors have been considered in the project when using user-driven innovation with the end-users, with the aim to develop the most likely solutions to be realized.

In the field of information technology the widely used and proven Technology Acceptance Model (TAM) was developed by Fred Davis (Davis, 1989). The model is an extension of the Theory of Reasoned Action TRA, (Ajzen, 1980), mainly replacing several attitude measures such as consumer attitude or consumer behaviour. Two technology acceptance measures are perceived ease of use and perceived usefulness, where 'ease of use' is defined as the degree to which the user believes that the new development may be used effortlessly and 'usefulness' defined by the user believing there is an advantage or benefit when using the new development. It is assumed that increased perceived usefulness combined with increased behavioural intention increase the level

of adoption, see also ‘The Unified Theory of Acceptance and Use of Technology’ (UTAUT), (Venkatesh et al., 2003).

Figure 1. Principle of user driven innovation model for the new approach.



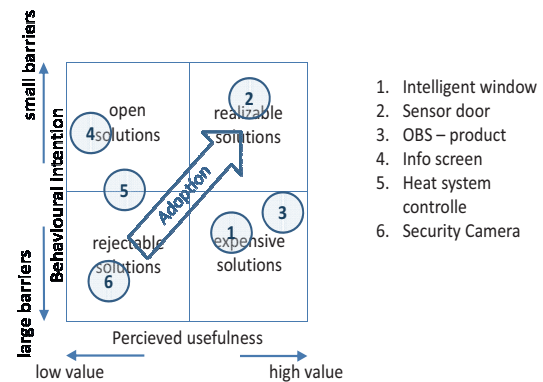
TAM defines behavioural intention as a measure of the strength of one’s intention to perform a specific behaviour, i.e. it may indicate willingness to use a new solution. In early-stage innovation this is assumed to be approximately correspondent to the user awareness of his own barriers on the possible solution. Perceived usefulness is in the context of user driven innovation considered as the users own perception of the value if the solution, e.g. increased relative advantage.

## METHOD AND RESULTS

The early stage innovation was generated through Dialogue Meetings (DM). At the DM all the users, technological experts and developers from the firms and an extended group of stakeholders, were brought together and involved in different settings, with the main purpose of brainstorming and creating ideas i.e. early-stage innovation. Two main methods were used: ‘Scenarios’ and ‘Design Games’, see (Brandt, 2004).

Several sustainable solutions has been developed in the early-stage innovation using the new approach, categorising the level of adoption, see figure 2.

Figure 2. Early-stage developed solution introduced in the TAU-model.



## CONCLUSIONS

It was shown that given the right condition and surroundings, and with the rightly chosen users, collaborative innovation with a strong focus on the adoption combined with user-driven innovation seems to be a useful approach for developing sustainable solutions in the early-stage innovation.

It was shown that an even higher degree of success could be achieved, when combining the basic principles of user-driven innovation with the parameters influencing the Technological Acceptance Models (TAM). Even though TAM models are normally used on IT solutions, it seems likely that these models may be extended to be used on other advanced technology solutions, e.g. sustainable solutions in the built environment.

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# **PREFABRICATION AS A SOURCE FOR CO-CREATION: AN INVESTIGATION INTO THE POTENTIALS FOR LARGE-SCALE PREFABRICATION IN THE UK**

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*Prefabrication, as a means of customer co-creation, can offer great opportunities if perceived accordingly. The research evaluates the use of prefabrication within the hospitality sector in the UK and identifies the advantages of, and hindrances on, its application as a tool to encourage client participation in the design process. A mixed methodology has been used to gauge the general attitudes towards prefabrication, prevailing technical understanding and knowledge of the concept, its applicability, and its perceived advantages and disadvantages. The research indicates decreased construction times and increased quality as the main advantages and poor current education within the industry regarding prefabricated practices, the archaic nature of the industry lacking trust, reluctance to embrace new and innovative techniques, and the absence of a proven holistic and encompassing evaluation technique to provide accurate and reliable comparisons between differing construction methods as main obstacles on the way. The study facilitates the identification of key factors associated with stimulating more efficient use of prefabrication within the UK construction industry. The outcomes will help the industry to develop and evolve to suit the needs of, and overcome the constraints imposed by and on, today's clients towards a more customer-centred construction industry.*

**KEYWORDS:** modern methods of construction, modern prefabrication, new modularisation, customer co-creation, value co-creation, mass customisation.

## **INTRODUCTION**

Prefabrication is a term subject to open interpretation within the construction industry, denoting any component or product that is fabricated off-site, transported to and assembled on site. In its broadest sense this could be a clay brick, moulded and blasted in a furnace off-site, and then transported to site and assembled with other prefabricated bricks to form a wall. Curl (1993) attempts to show the vast diverseness of this description by defining prefabrication as 'the manufacture of building components in a factory or elsewhere before transportation and erection on site'. To understand the concept of prefabrication within the construction industry mass production, and more importantly standardisation of elements, need to be carefully taken into account. The classification of the term prefabrication as an evolving concept can produce controversial opinions and arguments, depending on the depth, timeframe, and context.

Co-creation is arguably a market-driven production strategy which sets out to enhance customers' participation in the value-chain by developing its extensionality beyond the traditional market definitions. Probably first coined by Prahalad and Ramaswamy (2000, 2004), it was primarily aiming at deployment of customer competence. It eventually turned to address the transition of design/creation process from a closed one inside

the firm to a dynamic interaction between customer and the firm to add value. As a result the traditional one-off transaction as the contact point between each customer and the firm, evolved to a continuum of an experience which starts well before the actual purchase takes place but also continues way beyond that. In this sense co-creation is still a new concept in its disciplines of origin and even newer in built environment and construction industry.

## **Customer co-creation in the building industry**

In co-creation what forms the core debate is that each and every product regardless of their size, nature or specification can be broken down into two boundaries: One in which there exists flexibility of design supported by the corresponding technologies in fabrication and assembly stages – known as open area; and the other in which change and modification is restricted to the non-customer co-creators i.e. the designer, fabricator and assembler. This is known as closed area. The concept of open/closed areas of a product platform becomes more important in construction industry (compared to other manufacture and service industries) because of the concrete nature of the final product in construction industry. However, what contradicts with this very fact is that the added value in building industry is not merely determined by the performance. Despite other industries, in the building industry the value



is measured through aesthetics, representation and most importantly by scarcity as opposed to product performance in other manufacturing industries (Pawley 1990). In this sense prefabrication has been studied as a means of enhancement of the product platform by promoting the modern concept of modularisation. This will provide the production process with more open areas than before to be communicated with the customer and engage them in the production process more interactively and more efficiently.

## RESEARCH METHODOLOGY

With prefabrication in the centre of this research, a study was designed and carried out to figure out the extents to which MMC's are used in the UK construction industry, and the potentials to enhance this level as a facilitator of customer co-creation. The research sample consisted of eleven professionals currently operating within the UK construction industry, with an average experience level of 17 years. Representatives from the design, manufacture and construction sectors of the industry participated. The research was conducted in two stages. Using a pilot questionnaire general attitudes and opinions were gauged, and a semi-structured interview was used to further develop an understanding of the reasons for the current levels of use of prefabrication within the hospitality sector, and the hindrances and stimulants for increasing this.

## CONCLUSIONS

The research set out to discover what is perceived as the advantages and disadvantages of prefabrication. The main advantages of prefabrication were found as decreased construction times and increased levels of quality within the finished product, in comparison to more traditional construction methods. Within the research the main hindrances to the successful and effective use of prefabrication were identified. Education levels within the industry were identified as being poor, with a significant lack of formal routes of education provided for and an evident deficit in impartial and founded information regarding prefabricated techniques. The UK construction industry also demonstrated an inherent resistance to new and innovative techniques through the adoption of minimalistic and elementary unit based comparison methods. A severe lack of trust is prevalent within the UK construction industry between all parties, with the provision for open and symbiotic knowledge and information sharing relationships non-existent. The potential benefit of these appears to be offset by the perceived risk of detrimental effect, be it in a commercial, social, or practical form. The research identified the potential benefits and optimisation of current practices that could be realised through the

establishment of these symbiotic relationships, but co-creation as a concept can never be realised whilst the exposed preconceptions and inherent traits are present within the UK construction industry.

Throughout the research two key factors have remained prevalent in the realisation of prefabrication as a efficient and effective construction method; increase and improvement in the current knowledge levels through an increased availability of accurate and founded comparison data, and the development and provision for an accurate and industry-wide accepted evaluation technique regarding the selection of construction methods. The potential for co-creative symbiotic relationships has been identified, with the enormous benefits of these to all parties evident. The identification of a requirement for valid and independent research to improve education and knowledge levels shows the beginnings of appreciation towards the concept of co-creation, and subsequently promotes a sustainable and developing prefabrication industry based on a mutual understanding of all stakeholders' requirements.

It could be suggested that the multidimensional nature of the construction industry, with all projects and stakeholders imposing and requiring differing constraints, may impact upon the viability of the adoption of co-creation. On the contrary, a rapidly evolving and changing industry requires re-evaluation for each and every scenario encountered, and co-creation provides a concept and basis for a thorough and accountable analysis from all perspectives. Prefabrication provides a suited and appropriate tool for the evaluation of the effectiveness of co-creative techniques within the UK construction industry, but the dynamic nature of projects with regard to scale, scenario, constraints, and stakeholders will ultimately determine the suitability and adoption of such techniques.

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# BUILDING INFORMATION MODELLING AS INNOVATION JOURNEY: BIM EXPERIENCES ON A MAJOR UK HEALTHCARE INFRASTRUCTURE PROJECT

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*The evolving digital technologies and emerging practices of Building Information Modelling (BIM) represent an opportunity to transform existing modes of design, construction and operation. This paper discusses empirical findings from an ongoing longitudinal case study of a BIM implementation, specific the transition of BIM from the design office to the site environment and from the design phase to delivery phase. Interviews were conducted with BIM innovators and users working for a large international contractor on a major hospital development project in the United Kingdom. The analysis draws on Van de Ven's model of the 'innovation journey' and the associated analytical categories of; ideas, people, transactions, context and outcomes. Analysis of the development and use of BIM on the project reveals the emergent and dynamic nature of the innovation process as it unfolded over time. Although the accounts of the BIM development bore many similarities with the innovation journey findings, we found suggestions of differences in the areas of 'people' and 'context' where our respondents seems too have created more stable and manageable situation than the innovation journey concept would predict..*

KEYWORDS: BIM, innovation journey, hospital

## INTRODUCTION

In the area of digital construction research, Moun et al (2009) have identified "a growing interest among several research communities in the experiences gained from applying new technologies to practice" (2009: 229-30). The research described in this paper, reflects that interest. It is a case study of a project-centred innovation to develop and implement Building Information Modelling (BIM) technologies for use on a major UK healthcare infrastructure project. Our analysis draws on Van De Ven et al's (1999) concept of the 'innovation journey'.

## Building Information Modelling

Building Information Modelling (BIM) is a term used to refer to a family of technologies and related practices used to represent and manage information the construction process. In this case these were: portable tablet computers; 3D BIM models; a document management system; BIM integration database.

## The Innovation Journey

The 'innovation journey' is a term used to encapsulate the findings of an influential series of studies into the "inherently uncertain and dynamic" processes of innovation - the Minnesota Innovation Research Program (MIRP) Van de Ven et al, 1999; 3). These studies challenged 'traditional' innovation models as they found no evidence for up-front strategic planning, single champions or

linear stages in innovation development. Rather, researchers found a proliferation of ideas developed by many entrepreneurs fluidly engaging & disengaging over time in a fluctuating network of stakeholders creating & constrained by multiple environments leading to an unpredictable and indeterminate final result.

## Method

The research design is an on-going longitudinal case study undertaken in phases of retrospective data collection (Harty, 2008). The case studied is an innovation project to develop, adapt and adopt a range of BIM tools by the main contractor to support site operations on a major hospital project in the UK. The empirical method was semi-structured interviews with additional supplementary data (documents, meetings, observations) and analysis. The analysis adopted in the paper takes an exploratory approach to post-hoc application of the MIRP analytical categories (Ideas, People, Transaction, Context, Outcomes) to our data.

## Analysis: The BIM Innovation Journey

The evolution of 'ideas' and the overall innovation process for our BIM case study is well described by the innovation journey concept. The project change from design to construction coincided with a significant change in the idea of what BIM is for. For example, the use of the 3D BIM models was originally intended to be used to produce a

coordinated design only but underwent a major shift to being regarded as an exploitable resource that could be used to support site operations

Our data also has elements that seem to confirm the importance of ‘*transactions*’ required. Although they downplayed relationships within the innovation team, respondents identified important relationships between them and more peripheral or external agents. Particularly highlighted are personal relationships between innovation team members and individual software developers and more ‘corporate’ relationships between the project and the contractor’s corporate IT department. Interviewees have stressed that at times work on the BIM project was ‘unofficial’ – particularly when developing what amounted to proof-of-concept working prototypes. This made the innovation reliant on personal relationships

Our findings are short on ‘*outcomes*’ but this is probably due to the research method – the post-hoc nature of the study and that outcomes are largely implicit. Our respondents did not tend to describe their innovation journey in terms of explicit outcomes. There have been attempts to demonstrate business benefits from the technology use (better control, time savings) but these are still being worked on and in any case do not seem to have been part of the interim outcomes that drove the innovation process.

In this study, wider ‘*context*’ issues whether supportive (such as the increasing potential of computers) or constraining (like the perceived computer illiteracy of many construction users) were mentioned but not emphasised by respondents. What seem more significant in explaining what has been framed as a ‘project innovation’ are a number of project contextual factors (scale, complexity, procurement method and project organisation) that have influenced the development of the tablet computers and related BIM systems. It seems likely that the idea of the BIM innovation as a project-centred innovation is the reason that wider contextual issues were relatively down-played or taken for granted in the interviews. Framing the BIM developments as a project-based innovation will also have been useful and necessary during the innovation journey to gain support for the changes and to protect progress against changes and restrictions from the wider context.

In terms of ‘*people*’, the MIRP studies would lead you to expect a fluid network of part-time entrepreneurs. In our study, a number of peripherally involved people fitted this description – mainly approving directors and user supporters. However, the core innovation team appear to have

formed a consistent and stable full-time group for the duration of the innovation period studied. This may have been due to the relatively short duration plus fairly simple nature of our innovation case study compared to those in the MIRP research. Tentatively though, this could be a significant difference arising out of the project-based nature of the innovation and the apparent ability on the part of the team to hold this aspect constant. As with the relatively simplified, and more manageable project context, this appears to have been important in maintaining the innovation.

Methodologically, applying the MIRP categories to our data highlighted the difficulties of constructing precise empirical accounts of innovations from retrospective interview data. Respondents did not generally talk in terms of specific incidents or events but rather in terms of broad narratives and statements about steady states or ‘how things are’. As a coding framework, the MIRP categories were not exclusive and highly dependent on where the analyst draws boundaries.

## CONCLUSIONS

The BIM innovation journey demonstrated many of the significant features of those studied MIRP, particularly the non-linear nature of the process, the emergent nature of the ‘ideas’ and the importance of a range of different ‘transactions’. However, the project-based nature of the innovation seems to have allowed the innovation team to have limited the complexity and turbulence of ‘people’ and ‘context’.

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# CONCEPTUAL FRAMEWORK FOR IMPROVING THE CONSTRUCTION SUPPLY CHAIN

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*The performance of the construction industry and the construction process in particular has always been a burning issue in the industry and academia. The issue at stake is the prevalence of unsatisfactory project delivery outcomes. In order to address this issue performance improvement tools such as supply chain management (SCM) was introduced into the construction lexicon. Given the notoriety that poor performance has engendered in construction, an attempt to realise improvement through the exploitation of the potential of SCM in construction is highlighted in this paper. The methodological approach adopted entails an in-depth review of literature relative to performance and SCM in construction. Findings emanating from the study indicate that deployment of principles of risk allocation and management, human resource development, knowledge management, organisational culture, logistics management, integrative H&S and quality management practices cannot only improve the performance of the construction supply chain, but can also positively impact on the construction process in terms of cost, H&S, quality and time, to the extent that project delivery outcomes will improve substantially.*

**KEYWORDS:** Construction, performance, Supply Chain Management

## INTRODUCTION

Storey et al. (2006) contend that nestled beneath the dominant big idea of SCM as a whole are a number of sub theories such as seamless flow from initial sources to final customer, a demand-led supply chain (only produce what is pulled), shared information across the whole chain (end to end pipeline visibility), collaboration and partnering (mutual gains and added-value for all), information technology enabled, all products direct to self, batch / pack size configured to rate of sale, customer responsiveness, agile and lean, mass customisation, and market segmentation. Therefore, SCM in the construction context represents a move away from the project and its management, towards the supply chain and its management, as the main focus in order to engender more effective ways of creating value for the clients; as a vehicle for innovation and continuous improvement, integration of systems and maybe even improved, industry-wide, profitability levels (Pryke, 2009). This shift nonetheless retains the emphasis relative to the impact SCM has upon project objectives and performance (Bresnen, 2009).

## CONCEPTUAL PERSPECTIVE

Venkataraman and Pinto (2008) suggest that as a direct result of factors such as globalisation, best value for customer money, inventory management, risks, uncertainties, and complexities associated

with projects, the adoption of SCM approaches in construction becomes a necessity. According to them, SCM approaches such as partnering, information and risk sharing can greatly reduce uncertainties and complexities inherent in projects; and management approaches associated with SCM such as lean construction, TQM, purchasing, distribution, and logistics management, These approaches will not only enable organisations to realise major gains through the elimination of waste in the process, but will also provide opportunities for businesses to improve their operations.

Figure 1 Causal Network: Seamless project delivery

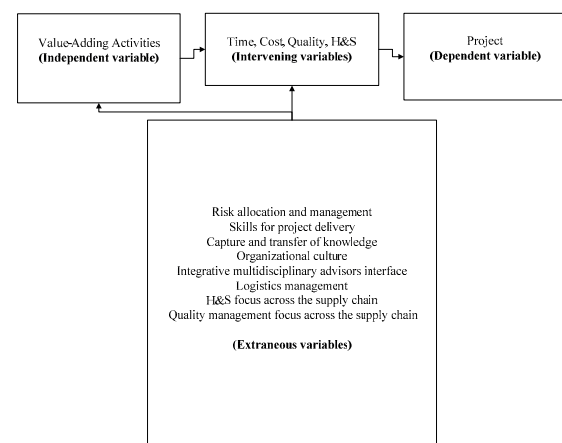




Figure 1 indicates a causal network that reflects the assumed research conceptual perspective that provides a theoretical overview of the research through the use of independent, dependent, intervening, and extraneous variables (Trafford & Leshem, 2008).

The independent variable is responsible for realising change or changes in a phenomenon or situation, the dependent variable is the outcome of the changes brought about by the introduction of an independent variable; the extraneous variables are several factors operating in a real-life situation that effect changes in the dependent variable, that is, these factors may increase or decrease the magnitude or strength of the relationship between independent and dependent variables; and the intervening variables link the independent and dependent variables, that is, the cause variables will have an effect on the dependent variable only when the intervening variable (Kumar, 2005).

Arguably, due to the nature of the variables under investigation, pluralism in the research methodology as against a single methodological approach seems a practical approach. Though construction management research is seemingly rooted in quantitative research methodology, the operational steps relative to this study intend not only to embrace pluralism (Dainty, 2008), but also intend to emphasise the reliability and validity of data generated through mixed-mode quantitative methods (de Leeuw & Hox, 2008).

## CONCLUSION

In conclusion, in as much as project coalitions continue to play key roles in the construction process, their contributions will continually influence the quality, and availability of built facilities. As a result, efforts directed towards harnessing the contributions of project partners provide a positive platform for performance improvement in construction. It is instructive to note that the robust application of risk management practices, skills development, knowledge capture and transfer, organisational culture, integrative multidisciplinary consultants interface, logistics management, integrative H&S and quality management practices as illustrated in Figure 1 within the strategic and operational aspects of the construction process may offer improvement possibilities.

Further, the paper re-emphasises the importance of value-adding activities in relation to improving performance on construction projects with the aid of the extraneous variables identified in the conceptual framework so as to engender continuous improvement in South African construction. Finally, issues that were discussed so

far provide a basis for further rigorous empirical research relative to the ability of SCM to provide platforms for addressing non-value adding activities and poor performance in construction.

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# CLIENTS AS DRIVERS OF INNOVATION: LESSONS FROM INDUSTRIALISED CONSTRUCTION IN SWEDEN

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*Stakeholder pressure is an important trigger for innovation. Industrialised construction (IC) has been proposed as a means to improve the building sector, nonetheless, Swedish clients are not facilitating IC. The purpose of this research is to further the understanding of the client's role, as a decision maker, for improving the rate of innovation in construction by learning from how clients respond to IC in Sweden. Analyses of data from 27 Swedish property owner organisations indicate that IC is associated with uncertainty and equivocality, and that investment decision-making on new-build is concerned with potential losses and regret rather than with gains. Due to such biases, decision theory suggests that even when an innovation is considered a better provider of desired outcomes, clients are likely to decide on common practice. Drawing on information processing theory, analysis shows that current information processing practice does not support reduction of uncertainty, or management of equivocality. To drive innovations such as IC that can change status-quo, clients must be able to manage equivocality as information is scarce, and common practice is challenged. For clients to benefit from innovations, a higher involvement in early innovation development is proposed.*

**KEYWORDS:** Construction client, Decision making, Industrialised construction, Innovation, Uncertainty

## INTRODUCTION

Industrialised construction (IC) has been proposed as a means to improve the building sector (see e.g. SOU 2000, Goodier & Gibb 2007), and stakeholder pressure is an important trigger for innovation. Nonetheless, although positive to the expected benefits, Swedish clients are not facilitating IC (Statskontoret 2009) or driving the change towards industrialisation.

The purpose of this research is to further the understanding of the client's role, as a decision maker (DM), for improving the rate of innovation in construction by learning from how clients respond to IC in Sweden. IC encompasses novelty in multiple dimensions and thus brings about the characteristics of an innovation seen from the clients' perspective. Hence, IC challenges common practice and shared pictures of how things can and should be done in order to realize construction.

Data files addressed in this research encompass clients' perspective and decision making on IC, and was collected from 27 Swedish property owner organisations during 2006-2009. The analyses focus on client investment decision-making on new-build and is based on information processing (IP) and decision theory.

## A DECISION MAKING PERSPECTIVE ON INNOVATION

DMs missing information typically rely on rules of thumb, i.e. heuristics (c.f. Tversky & Kahneman 1974), to simplify IP and fill information gaps (March 1994). Although often helpful, these

cognitive processes lead to biases, which explain why decision making do not follow normative models or result in the highest expected utility (c.f. Tversky & Kahneman 1974). The work on prospect theory by Kahneman & Tversky (1979) implies that a higher probability choice is preferred even if it offers lower expected utility, since losses loom larger than gains. Toole (1994) elaborates on previous research and argues that DMs; compare levels of regret rather than benefits; associate uncertain alternatives with higher levels of regret, and; avoid such alternatives. DMs also tend to stick with previous decision, i.e. the status-quo alternative. Samuelson & Zeckhauser (1988) suggest explanations for the status-quo bias such as e.g. regret avoidance and presence of uncertainty.

In research on high uncertainty innovations in home building, Toole (1994) concluded that; potential adopters would rarely adopt without gathering additional information; existing products or methods would be judged to offer the highest relative advantage, and; those more apt to adopt innovations had superior IP abilities related to building innovations and involved more functions in decision making.

## MANAGING BIASES IN DECIDING ON INNOVATION: AN IP PERSPECTIVE

To reduce uncertainty, organisations enable additional data processing (see e.g. Galbraith 1977), ask a large number of questions, and acquire information and obtain answers to explicit questions (Daft & Lengel 1986). However, a situation can be interpreted in more than one way,

and DMs can be in a position of not knowing what questions to ask, or of there not being any clear answers (March & Olsen 1976). In such cases, one has to deal with equivocality rather than uncertainty (Daft & Lengel 1986).

Equivocality is about confusion, lack of understanding, disagreement, lack of clarity and ignorance, i.e. not being able to define influencing variables or interpret available information (see e.g. Daft & Lengel 1986; Weick 2001). The solution for resolving equivocality differs from that for reducing uncertainty. Instead of seeking answers, the organization seeks clarification, problem definition and agreement through exchange of subjective views and opinions (Daft & Lengel 1986). Thus, managing biases in deciding on innovation is not only a question of gathering and processing high amounts of information, but also about how it is gathered and processed.

### BIASES IN CLIENTS DECIDING ON IC

From the analysis of client investment decision-making on new-build, anticipated regret emerges as a prominent issue. Clients explicitly expressed a fear or anticipation of future regret following on the choice of IC over any other alternative, considered more conventional.

The analysis also indicates that client equivocality is more prominent when considering an IC alternative than the status-quo alternative, and; current IP practice does neither support the systematic gathering of data, nor enable transfer of rich data. Consequently, the current IP practice does neither adequately support the reduction of uncertainty, nor the management of equivocality within the decision-making process on new-build.

### CONCLUSIONS AND DISCUSSION

Due to uncertainty and equivocality, clients are concerned with the potential losses and regret rather than with gains when facing IC. The anticipations of future regret could be part of the reason for the slow uptake of IC in Sweden. Clients are proposed to choose tradition over innovation, even when the latter is considered the better provider of desired outcomes, such as short time spans and low cost. This is consistent with Toole's (1994) findings in a study on potential adopters of high uncertainty innovations in home building in the US.

Indeed, the fastest way to reduce equivocality is probably to stay with status-quo. The IP costs are thereby cut short, risks can more easily be calculated and potential losses are known. In the long run, however, such behaviour will prevent organisations from innovation uptake, and act as a change-restraining force within construction. To

drive innovations such as IC that can change status-quo within individual client organisations, but also on a sector level, client organisations must be able to manage equivocality as the amount of information is low, and common practice is challenged. For clients to benefit from innovations, a higher involvement in early innovation development is proposed.

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# PARTNERING AND THE FOUR DIMENSIONS OF COLLABORATION

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*In order to reap the benefits of partnering implementation by improved collaboration it is vital to increase the understanding of the partnering concept and its content. This paper investigates four different dimensions of collaboration in order to enhance a better partnering conceptualisation. Empirical data was collected through a multiple case study of four engineering projects in one Swedish mining company. The empirical results show that partnering was implemented in different ways in the projects, revealing four dimensions of collaboration: width, depth, duration, and intensity. The developed framework based on four dimensions of collaboration provides opportunities for more detailed and yet more holistic practical and theoretical understanding of the partnering concept.*

**KEYWORDS:** Partnering, Collaboration, Procurement, Project governance

## INTRODUCTION

The interest in and promotion of cooperative inter-organizational relationships, often termed partnering (Bresnen & Marshall, 2000), has increased during the last decade in many countries (Wood & Ellis, 2005; Eriksson, 2010). Compelling evidence that partnering indeed results in improved performance is however still scarce, since collaboration and its benefits are not easily obtained in construction projects (Skaates et al., 2002; Kaluarachchi & Jones, 2007).

One reason for disappointing results is that industry actors sometimes lack the understanding of the partnering concept and how to implement it (Akintoye et al., 2000; Saad et al., 2002). In order to better reap the benefits of partnering implementation by improved collaboration it is therefore vital to increase the understanding of the partnering concept and its content. This paper investigates four different dimensions of collaboration in order to enhance a better partnering conceptualisation.

## METHOD

Empirical data was collected through a multiple case study of four engineering projects (A, B, C, and D) in one Swedish mining company. The data was collected through 50 semi-structured interviews (a total of 66 hours) with respondents mainly representing the client's project organizations (35 interviews), but also from the partner organizations (15 interviews). The client respondents included the director of the construction project department, project managers, procurement managers, quality managers, design managers, and various specialists involved in time scheduling, and quality control. The partner respondents included site managers, contract manager, design consultants, and engineers.

Additionally, approximately 20 hours of document studies were performed, focusing on partnering charters, incentive arrangements, and tendering and contractual documents.

## EMPIRICAL FINDINGS

The empirical results show that partnering was implemented in different ways in the projects, revealing four dimensions of collaboration. 1) Width: In projects A and B partners were involved in different partnering teams. In order to obtain a broader perspective on collaboration and avoid suboptimisations in projects C and D one broad partnering team was established in which all key actors participated.

2) Depth: In projects A and B partnering mostly involved managers and white collar workers. In order to spread collaboration deeper into the project organisation where the actual construction work is performed blue collar workers were involved in Project C. In addition, end-users were explicitly involved in Projects C and D in order to obtain their valuable input to customize the design.

3) Duration: Key actors were involved in partnering from early to late project stages in projects A, B and D, both in order to enhance buildability and to make parallel design and construction in concurrent engineering possible. In project C the contractors were not involved in design but had a contractual option to be involved also in subsequent project. These two different ways of lengthening the duration showed both benefits and problems in terms of collaboration, for which reason the implementation of both strategies has to be made purposefully.

4) Intensity: cooperative procurement procedures enhanced more or less high intensity of collaboration in all four projects. In Projects C and

D the collaboration intensities were high both within and across contracts due to broad partnering teams.

Construction Projects. *Construction Management and Economics*, 23 (3), 317-25.

## CONCLUSIONS

The developed framework based on four dimensions of collaboration provides opportunities for more detailed and yet more holistic practical and theoretical understanding of the partnering concept. The empirical findings show that in complex engineering projects higher levels of width and depth than what is often described in prior partnering literature and practice may be beneficial due to the strong interdependence of many actors that need to coordinate their activities. Longer duration through early involvement of contractors can save time and improve buildability, whereas longer duration through long-term contracts can provide opportunities for continuous improvements. The challenging characteristics in terms of complexity, customization, uncertainty, and time pressure make collaboration intensity important in engineering projects.

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# PARTNERING, LEAN CONSTRUCTION AND HEALTH AND SAFETY WORK ON THE CONSTRUCTION SITE: CO-PLAYERS OR OPPONENTS?

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*Each new construction project is organised with new clients, consultants and contractors every time. Planning and coordinating the construction process and the specific health and safety work on the construction site must therefore also be organised each time. In recent years, partnering and Lean Construction have been introduced as new forms of cooperation between the actors in construction. Simultaneously, new regulations have been implemented that place the responsibility for health and safety conditions on clients. Partnering and Lean Construction were studied with a focus on the importance of, and interaction with, health and safety on site. Production as well as health and safety are often perceived as two separate areas with different key actors and they are handled as two different management areas with their own embedded management problems. This despite, the fact that it has long been known that health and safety is dependent on the organisation and execution of production and that a familiar theme in the management of safety is to avoid a sidecar mode of production. The study applied theories on construction management and construction safety management. The research methods were based on trade analysis and studies of 5 building projects on site. The trade analysis was performed by interviewing focus groups. The construction sites were observed over a six-month period by applying the methods: Observation, documentation and interviews. It was concluded that 1) synergy between partnering and Lean Construction, and health and safety work can be achieved, 2) there has to be a driver to facilitate the interplay between the management areas, 3) all the actors can drive the process, 4) as drivers they have to handle context-dependent dilemmas.*

KEYWORDS: Partnering, Lean Construction, Health & safety, Management, Construction site

## INTRODUCTION

The Sidecar Effect of health and safety (H&S) work has long been a familiar phenomenon (*cf.* Jensen, 2002: 204). Sidecar location characterises a situation where safety is disconnected from the core performance and function in an isolated system – a situation that for years has been criticised for isolating the H&S work.

With the emergence of a series of new partnership models and forms of cooperation, the scene has, however, recent years been set to develop new project governance frames that might be able to move H&S work might away from its location as "sidecar".

Accordingly, the paper explores implications of bringing H&S work in play together with the new forms of partnerships. In doing so, the following objectives have been pursued:

1. What kind of impact would new concepts of partnerships have on H&S work in construction?

2. Could the development and implementation of the new concepts be planned in ways that would also promote good H&S conditions?
3. What role could H&S play in the readjustment of construction?

## METHODS

The project was a qualitative development project designed as an iterative sequence, in which each phase is a precondition for the next phase, with on-going adjustments and corrections of the field of study, methods and results. The project and method used consisted of the following main phases:

1. Preparation, gathering and systematisation of existing experience with the implementation and utilisation of new concepts of cooperation (Literature study)
2. Gathering of experience of new cooperation concepts and H&S at the construction industry level (Focus group interviews with different actors in the construction industry)



3. Gathering of examples of practice with new cooperation concepts and H&S on the construction-site level (Interviews with different actors on site, observations and data collection in five on-going construction projects)
4. Intervention on construction sites; integration of H&S work in the new concepts of cooperation (Test on five construction project over a one-year period)
5. Analysis of the experiences gathered and development of a guideline of recommendations.

## FINDINGS

Concerning H&S work and new forms of cooperation, the following findings were made.

### H&S Work and partnering

H&S work could exploit that partnering established a common forum already in the design phase. This created the possibility that parties could jointly discuss - not only technical construction issues, but also the work environment - opportunities and problems, so that the project was planned to get the most effective and safe project implementation. The early dialogue, the setting of common goals and the ensuing dialogue engendered by common objectives were key elements in the discussion of how partnering could contribute to a common focus on H&S and create new opportunities in the area. Conversely, H&S work activities and H&S actors could contribute to a better planning in a partnering project, so it could proceed without unnecessary stops due to unforeseen H&S problems.

### H&S Work and Lean Construction

In connection with the systematic H&S work working conditions will often be identified where solutions should be found. In the process planning, solutions could often be found to H&S conditions and the solutions could be operationalized. Some of the solutions would also help to improve the production process. Lean Construction and the formal H&S work could support each other. Experience suggested that for example input from the Last Plan System and work place assessment in the early process planning could prevent poor working posture when handling building materials by early planning of scaffolding, and improved logistics. Experience suggested that input from the current H&S work (safety rounds, safety meetings, etc.) to Last Plan System meetings, could support for example clean-up that fences were in order and coordination of the different trade groups' work. In that sense, using the Last Planner System could realise new ways to integrate safety aspects as early

as at the planning and coordination stages of production.

## CONCLUSIONS: DILEMMAS IN H&S WORK IN CONSTRUCTION

The results showed that synergy can be achieved between partnering and Lean Construction, and H&S work. There has to be a driver to facilitate the interplay between management areas, and it seemed that all the actors could drive the process. Because construction projects are project-organised, the context, the actors and the actors' interaction will be new each time. This means that every time the actors want to drive the interplay between new partnerships models and H&S, they cannot use routines but have to handle dilemmas which are context-dependent.

The dilemmas for the different actors shown in this paper were:

Client: Client demands can act as drivers, but they can also be barriers for developing safety behaviour on site

Safety coordinator: Coordination may visualise simplicity/interaction when interfaces are clear but may cause confusion when interfaces are pressed

Construction manager: Plans, management and control can promote the production, when craftsmen are not competent, but inhibit production when craftsmen are competent

Department of H&S: Documentation may increase oversight and provide a basis for new strategies by the contractor and thus help to solve H&S problems but at the same time increased demand for documentation from the construction sites can take time from problem solving of H&S conditions on site.

Safety organisation: In the development of partnerships those converging aspects of H&S are promoted, while other H&S issues risk to be forgotten.

## ACKNOWLEDGEMENTS

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# LEVERAGING R&D INVESTMENT FOR THE AUSTRALIAN BUILT ENVIRONMENT

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*This paper discusses a current research project building new understandings and knowledge relevant to R&D funding strategies in Australia. Building on a retrospective analysis of R&D trends and industry outcomes, an industry roadmap will be developed to inform R&D policies more attuned to future industry needs to improve research investment effectiveness. The project will also include analysis of research team formation and management (involving end users from public and private sectors together with research and knowledge institutions), and dissemination of outcomes and uptake in the Australian building and construction industry. The project will build on previous research extending open innovation system theory and network analysis and procurement, focused on R&D. Through the application of dynamic capabilities and strategic foresighting theory, an industry roadmap for future research investment will be developed, providing a stronger foundation for more targeted policy recommendations. This research will contribute to more effective construction processes in the future through more targeted research funding and more effective research partnerships between industry and researchers.*

**KEYWORDS:** R&D policy; R&D diffusion; innovation systems; strategic foresighting; industry roadmapping

## BACKGROUND

This paper describes research currently underway evaluating impacts, diffusion mechanisms and uptake of R&D in the Australian building and construction industry. Starting with a retrospective analysis of R&D trends and industry outcomes, a future-focussed industry roadmap will be developed to inform R&D policies more attuned to industry needs, to improve research investment effectiveness. This collaborative project brings together academic (Australia and Finland); Australian government agencies at state and national levels; and private sector players to address this critical issue. The project aligns with the Organisation for Economic Co-operation and Development *Innovation Strategy* which highlights the need for a whole-of-government, coordinated and medium- to long-term approach to innovation policy (OECD 2010).

This research will develop new theory for interactive innovation, built on open innovation, dynamic capabilities and absorptive capacity theories, in the context of strategic foresighting and industry roadmapping. This is based on the hypothesis that each of these theories can be brought together to address the specific characteristics and tensions which impact R&D in this industry.

## SIGNIFICANCE OF THIS RESEARCH

The Australian Department of Innovation, Industry, Science and Research (DIISR 2010) identifies an overall decline in spend on science and innovation

as a percentage of GDP in Australia since 1993-94 of 22% (DIISR 2010:2). Australia's spend on R&D as a percentage of GDP is 2%, compared to that of Denmark and the United States of 2.5%; and Finland and Sweden of more than 3% (DIISR 2010:3). To address this, the Australian Government has identified a number of key initiatives including a target of a 25% for increased business engagement in innovation in the next 10 years; supporting targeted responses to climate change; improving workplace innovation skills and capabilities; and maintaining a focus on business innovation through council's such as the Built Environment Industry Innovation Council (DIISR 2010:6).

More specifically the relatively poor innovation record of the building and construction sector in Australia (Hampson and Manley 2001) continues. Recent findings reveal that trend performance of this sector in terms of Gross Value Added outcomes remains well below that of the manufacturing sector, despite a considerable drop in that sector's performance in the past three decades (DIISR 2009:24).

## NEED FOR THIS RESEARCH

Current methods to understand and improve the process of R&D investment in the Australian building and construction industry are not currently well linked to important environmental, social and economic drivers such as technological and market developments. There is a lack of compelling case studies, and only limited innovation frameworks of

relevance to this industry. As such there is an urgent need to study the dynamics, constraints and future vision for the industry using a structured methodology to gain this understanding. This is an essential precursor to new strategic policy responses that explicitly respond to the key emerging industry drivers and place the industry in the optimum position to leverage R&D to improve its performance.

## AIM AND INTENT

The key aim of this research is to build new understanding and knowledge of R&D dissemination and uptake in the Australian industry, and thereby develop robust, sustainable pathways to increase the safety, productivity and competitiveness, economic security, workplace capability and environmental sustainability of the industry. The context for this aim are the recently developed industry KPIs established to track industry productivity performance (Furneaux et al. 2010).

The intent is to develop new models of interaction and investment that maximise the value of R&D investment in this and like industries. These models will be based on improved understandings of the nature of future industry research needs, and lessons learned in diffusing research outcomes into public and private industry practice.

Four project phases have been designed to achieve these aims and intent. These are: (i) an audit and analysis of R&D investment in Australia from 1990 to 2008; (ii) case studies investigating past industry dissemination and uptake mechanisms; (iii) a strategic foresighting process to develop an R&D roadmap for future investment; and (iv) development of R&D investment policy and guidelines.

## RESEARCH METHOD

To achieve its stated aims and intent, this research will develop a methodology to analyse and understand the multiple facets of the industry through the investigation of three research questions:

- 1) What are the success criteria and critical challenges which impact the industry's ability to maximise benefit from R&D investment?
- 2) What input into, and outcomes from, strategic foresighting and roadmapping are required in order to develop an effective R&D investment strategy?
- 3) What policy directions and initiatives are required to promote the pathways identified in the strategic roadmap?

The methodology underpinning this research brings together the combined strengths of the research team, and the practical working knowledge of industry collaborators. Researchers will integrate existing construction and management theory (specifically open innovation, dynamic capability and absorptive capacity theories) in the context of a strategic foresighting and industry roadmapping process. Through this process, this research seeks to highlight and address the tensions which exist in both the theory and in industry in order to better foster the uptake of R&D outcomes in this industry.

## DISCUSSION

There are several anticipated outcomes of this research including: (i) advancing the knowledge base; (ii) developing a new integrated innovation methodology with the potential to lead to better understanding and dissemination of R&D outcomes; (iii) building an extensive knowledge base of underlying drivers, success factors and challenges for innovation in this industry; and (iv) contributing to policy development for this industry for the coming decade.

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# REVISITING BOUNDARY OBJECTS: ERP AND BIM SYSTEMS AS MULTI-COMMUNITY ARTEFACTS

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*This paper revisits the early conceptions of boundary objects, with a view to unpacking the multiple ways in which boundary objects are constructed, shaped and deployed in practice across multiple communities within construction contexts. This is significant given both the role of technologies in transforming practice within the sector, and the ways they affect and are shaped by traditional practices and institutional conventions. We do this through analysing and comparing two different empirical cases – the implementation of an Enterprise Resource Planning system (ERP) in a large engineering consultancy and the use of Building Information Modelling (BIM) to coordinate the design and construction of two large hospitals in central London. Both BIM and ERP have complicated and on-going histories, and involve the inclusion of many different groups and actors, as well as a plethora of objects in circulation between them. They therefore make useful sites within which to problematise and explore the dynamics and implications of boundary objects.*

KEYWORDS: boundary object; ERP; BIM; community

## INTRODUCTION

From its inception in the work of Star and Griesemer (1989) the term ‘boundary object’ has become widely used across a range of disciplines to explore issues of knowledge generation, sharing and transformation and the role of artefacts and technologies across epistemologically distinct groups (e.g. Wenger 1998, Carlile 2002). However this series of appropriations has led to criticisms that the term has become overly ‘managerial’ and unitary in use, focussing on the benefits of the production of objects which are able to harmonise the interactions between diverse groups, and enable largely unproblematic knowledge transfer. This has been at the expense of understanding the power implications inherent in such transactions (Contu & Willmott 2004, Oswick & Robertson 2009) and the effects of power on the production and transformation of boundary objects themselves. Theoretical suspicion and empirical evidence has led some scholars to reject the efficacy of boundary objects in situations where spatial or epistemological distance is coupled with a lack of other mechanisms of interaction (Sapsed and Salter 2004).

There is a further tension within the dynamics of boundary objects – that through their mutual production and operation, tensions are resolved and a point of closure is achieved where stable objects can facilitate straight-forward exchange. But other literature on the construction and shaping of artefacts points towards coercion, multiple interests and proliferation, continual flux as well as closure – indeed Star and Griesemer’s original conceptions draws on Callon’s model of intersement. In addition, artefacts can have complex and highly contextualised biographies, extending considerably

back (and forward) in time and following circuitous paths and trajectories. The production of boundary objects is arguably grounded in history just as much as in the necessity of interaction between groups around a particular problem or activity.

## TYOLOGIES OF BOUNDARY OBJECTS AND EMPIRICAL CASES

We present an analysis of the discussions of boundary objects by three of the main proponents in the field; Star and Greisemer (1989), Wenger (1998) and Carlile (2002). We take forward a set of types of boundary object or processes through which boundary objects are circulated: standardisation, objects or models, co-incident boundaries, maps of boundaries and accommodation. We then use these to discuss two empirical cases; the development of SAP / ERP systems in a consulting engineering group - Consultco, and the development of BIM (Building Information Modelling) systems during the design and construction of two large hospitals in the UK.

We use the cases to outline some of the tensions around the way boundary objects circulate and operate in our cases, through a discussion of standardisation through abstraction / deletion and accommodation. We argue that the centre of a definition of boundary objects should be fluidity – not in terms of interpretive flexibility, but rather that the boundary object itself is a temporal transition between disconnections across groups towards integration. One outcome of this process is the transformation of the boundary object to something more coherently accepted and ‘naturalised’ between communities. Another is that it becomes redundant as consistency cross groups is established.



## CONCLUSIONS

From our initial analysis, we draw a number of conclusions. The first is that we do see various forms of objects circulating between, and being employed by, different communities in different ways. The multi-community boundary object as ‘plastic enough’ yet ‘robust enough’ is evident, whether as an abstracted definition of BIM or a collection of user profiles in ERP. But we see these not in isolation, but as a complex network of objects and communities. The second is the complexity and dynamics of these objects, and the various processes which they mediate. Standardisation is a key feature, but this can be achieved through processes of deletion or abstraction, and / or extensive accommodation. Through these processes, the boundary objects themselves are transformed. Boundary objects both enable interaction and actively ‘push’ communities as they develop, whether through configuration, through standardizing process, or through introducing new opportunities from elsewhere.

A key aspect which is perhaps missing from some of the later literature around boundary objects is the outcomes of these processes, and the ‘life-cycle’ of the boundary object. Bowker and Star (1999) discuss the concept of ‘naturalisation’, where an object stops being on the boundary and becomes accepted as part of a community, or communities: “Some objects become naturalised in more than one world. They are not then boundary objects, but rather they become standards within and across [these] multiple worlds” (Bowker and Star, 1999: 312). So one outcome of the ‘biography’ of a boundary object is that it eventually becomes something else – something standardised and accepted across communities without controversy or the need for interpretive flexibility. But they suggest another alternative – the continual habitation of the borderlands between and across communities – a ‘monster’ which refuses the overtures of naturalisation. They argue that boundary object arise when different communities interact as “working arrangements that resolve anomalies of naturalization”. The processes of abstraction, of accommodation, of mapping (or recognizing) dependencies become the primary construction of boundary objects, which occur to both mitigate against, and perhaps move towards, naturalisation, standardisation and the integration of those communities.

As we look at the case studies, we see a complex web of objects circulating, communities transforming, standards emerging, with BIM and ERP at different stages of a journey. But these are processes of ordering, of achieving stable regimes of both boundary and naturalised objects. What is clear is the utility of the concept, and the potential

for further mapping of the dynamics and biographies of boundary objects in complex sets of interactions.

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# COUPLING PROJECT AND BUSINESS PROCESSES: EXEMPLIFIED BY DEFECTS AND ARBITRATION

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*Drawing on a study on the emergence of defects and arbitration, this paper will analyse how project processes are coupled with business processes in construction. Linking the project processes and the business processes are crucial for performance and innovation in construction. What is less clear is the character of these linkages. This study is based on a social-constructivist approach using documentary material and qualitative research interviews with strategically selected representatives of the construction process as well as the arbitration process. This paper suggests that points of accountability on performance provide excellent points of departure for analysing the links between project processes and business processes. A number of theoretical perspectives on couplings in construction as knowledge flows, as functions and regulation, as governance, as a loosely coupled system, and as ties have been identified. In conclusion this paper has proposed an alternative perspective on couplings as constitutive, which explores and challenges the very ontologies at play when it comes to analytical units, relations and effects. Consequently, the paper has sketched out alternative policy implications when it comes to improving performance and innovation in construction, most notably by mobilising leverage to change the perception of what counts as satisfactory.*

**KEYWORDS:** innovation, complex products and systems, organisation, quality, performance

## INTRODUCTION

As pointed out by numerous authors (see e.g. Gann & Salter 2000) the coupling between business processes and project processes are crucial for performance and innovation in construction. Still, most contemporary project management theories are dominated by a perspective on singular projects, thus ignoring the history and organisational context of the project according to Engwall (2003).

Drawing on a study on the emergence of defects and arbitration in construction, this paper will analyse how project processes are linked with business processes in construction. The emergence of defects and arbitration offers a valuable site to gain insights into the fundamentals of construction since defects and arbitration represent a potential disruption of the taken-for-granted assumptions of the firm, yet defects and arbitration is a routine in construction since it happens on such a regular basis. Thus defects and arbitration open up the on-going process of linking the project and the firm for closer inspection.

## SOME PERSPECTIVES ON COUPLINGS

This paper briefly introduce and discuss five different perspectives on couplings in construction as: 1) knowledge flows, 2) functional and regulatory mechanisms, 3) governance, 4) a loosely coupled system, 5) and ties.

Although their ontological and epistemological grounding varies, these perspectives seem less

occupied with understanding the making of couplings as routines. Instead, we would like to introduce an alternative perspective of couplings as stabilisation of sociotechnical change or routinisation.

## RESEARCH METHODOLOGY

This study applies the social-constructivist concept of technological frames developed by Bijker (1997), in which sociotechnical change cannot be understood without understanding how technology is embedded in its context.

This study has used a variety of methods including participant observation, documentary methods and qualitative interviews.

## CONSTRUCTING DEFECTS – DEFECTS IN CONSTRUCTION

In a previous paper, Haugbølle and Forman (2009) have deconstructed the interpretative flexibility of the concept of defects or deviance, as we would prefer it, starting from the bottom and moving upwards. We followed/identified the controversies on “defects” between the various relevant social groups in order to render the interpretative flexibility visible in relation to “defects” as well as the processes that allow the controversies to be closed. The four interpretations are deviance as normalisation, deviance as leverage/liability, deviance as a random effect, and deviance as precedent. Further, we have demonstrated how “defects” are socio-technically constructed through three main processes: concrete negotiations on the

gap between expectations and realisation, setting and applying ground rules for the game of construction and arbitration, and by producing structures in the shape of norms or codes of conduct. Finally, we have argued that the construction of defects can be explained as the result of interaction between two dominant technological frames: the building frame and the juridico-legal frame. The first frame is constituted by relevant social groups like building engineers, architects etc., construction technologies etc. The second juridico-legal frame is constituted by relevant social groups like building experts, arbitration methods, arbitration courts etc. Consequently, the system of arbitration and expert appraisals along with construction practices and strategies is co-shaping a culture of deviance/defects that both intentionally prevent defects but simultaneously foster defects unintentionally.

## DISCUSSION

First of all, we would like to point out that the couplings are dynamic in character. This may be a rather trivial observation that most observers would agree upon. However, we would like to hold that being dynamic is not simply a question of changing a weak tie into a strong one or increasing the frequency of interactions as implied in social network analysis. Rather, the dynamism of a coupling implies that the relationship may be more significantly altered, or more precisely that the couplings are being reconstituted. The study on defects and arbitration has shown how the emergence of defects and the arbitration process significantly alter the relationship between the project and the firm.

Second, we would focus our attention on the constitutive forces at play and their impact on our ontologies on performance, innovation, project, firms etc. Consequently, the configuration of actors and arenas is kept in place through couplings that not only extends and reshapes the boundaries of the project and the firm, but also shapes what counts as satisfactory or not. Couplings are not just couplings but are the very forces that keep the network together and make the sociotechnical ensemble obdurate.

Third, the policy implication is not to skip the management recommendations of the other theoretical perspectives, but to supplement these – or more radically confront the limitations of these perspectives. So if we want to improve performance in construction, we would need to address those forces that shape our very perception of performance. Thus, we would (not only) be looking for improving the coupling between the project and the firm, but we would explicitly

explore and challenge the very ontologies of what counts as a project and firm, and what constitutes performance and innovation etc. Put differently, the baseline remains the same if we do not change it! So if we want to improve performance and innovation in construction, we would need to change that very baseline.

## CONCLUSION

In sum, this paper has identified a number of theoretical perspectives on couplings in construction as: 1) knowledge flows, 2) functions and regulation, 3) governance, 4) a loosely coupled system, and 5) ties.

Further, the paper has suggested that points of accountability on performance of for example defects, value, cost etc. provide excellent points of departure for analysing the links between project processes and business processes.

The paper has analysed the emergence of defects and arbitration in construction as the result of the mutual shaping of two technological frames: the building frame and the juridico-legal frame.

This paper has proposed an alternative perspective on couplings as constitutive, which explores and challenges the very ontologies at play when it comes to analytical units (project/firm), relations (couplings) and effects (performance/innovation).

Finally, the paper has sketched out a number of alternative policy implications when it comes to improving performance and innovation in construction, most notably by mobilising the necessary leverage to change the perceptions in both the industry and the legal system of what counts as satisfactory.

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# DEVELOPING AND IMPLEMENTING CORPORATE CORE VALUES IN A CONSULTANCY COMPANY

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*Culture in organizations is a subtle governing framework which can either help or damage an organization. It is becoming increasingly more common for organizations to create core values that define how the company views itself and wants to be viewed by the society, in attempt to create a strong company identity and an inherent corporate culture that increases commitment and performance. However to successfully implement core values in a company there are a few factors that are crucial for a positive result, e.g. acceptance and clarity of the values. This paper studies how the core value development and implementation process has progressed for a large consultancy company in the construction industry with the aid of interviews with three different employees in different positions in the company. Comparing the findings from interviews with the theoretical framework of organizational culture and core values the paper concludes that the company could do more to address the factors for successful implementation of core values.*

**KEYWORDS:** organizational culture, core values, consultancy company

## INTRODUCTION

The analysed company have stated how they should conduct their work in order to gain a unified organizational culture and thereby also form a company image that represents how they want to be seen by customers. To achieve this, the company formulated four core values which they hope will direct the company toward common goals and to modernize their image. A common metaphor used in the paper to illustrate their current image is a comparison with a navy blue Volvo meaning that they are considered the safe, rather boring and traditional choice.

The company is an engineering consulting firm which operates in the construction industry, with around 300 employees that mainly work in Sweden. Recently, they have implemented the core values to attain a clear and homogeneous organizational culture and thereby guide their employees. The attempt has been made due to the rapid growth that has taken place during the last few years; they have acquired a new company and expanded geographically with many new offices. Due to the growth of the company and the recession that began in autumn 2008, the case presents an interesting perspective on how the company implemented and developed their core values during these challenging times for the company. Thus the paper's main focus is to try to establish how corporate core values are developed and implemented in a consultancy company.

Based on a case study this paper aims to address how development and implementation of corporate core values are made in a consultancy company within the construction industry. The case

presented a unique opportunity to investigate the process of development and implementation of core values, due to the changes and circumstances the company experienced after the development of the core values: the growth of the company and the recession.

## THEORETICAL FRAME OF REFERENCE

Organizational culture can be divided into artefacts which are observable, espoused values which people have emotional interest in, and basic assumptions that are the essence of culture (Clegg et al., 2008). Culture in an organization is often hidden and unconscious; it consists of the deep, basic assumptions and beliefs shared by an organizations members. Therefore, understanding organizational culture is important in order to investigate members' behaviour patterns, since the culture works as a governing framework for the organization (Ankrah and Langford, 2005).

With the aim to reach more unified thinking and shared values, the deliberate forming of corporate core values has become increasingly more common amongst large organizations (Osborne, 1991). The purpose of the values is to govern decision making and actions of all members in the organisation, i.e. create a sense of corporate morality that the organizational members work by. A strong organizational culture with shared values can lead to a strong company identity that can stabilise the social system and increase commitment amongst employees (French et al., 2008). In the implementation process of corporate core values there are a number of factors that are crucial in order to succeed with the implementation (Osborne, 1991). Firstly the core values must be

accepted throughout the entire organization and the key employees should share the articulated beliefs. Secondly the core values should be integrated in everyday activities in the organisation. Lastly, in order for the first two factors to affect the core values, they should be communicated well and clearly formulated and articulated in the organisation.

## METHOD

To collect information needed for this qualitative research, three interviews were made at a consultancy company in the construction industry during the autumn of 2010 in Gothenburg, Sweden. All interviewees had different positions within the company; The CEO of one of the subsidiary companies, a project administrator and a head of department. All interviews took place at the company office in Gothenburg where semi-structured interviews, lasting for approximately 50 minutes each, were conducted. These interviews focused on the process of developing and implementing the core values in the company and the perceived effects afterwards; e.g. how did the core values affect the structure and expansion of the company.

In order to get a fuller understanding of organizational culture and core values, the paper is also based on a literature study. Finally, the information collected from interviews were analyzed and compared to theories found in literature that are presented in the theoretical frame of reference part.

## RESULTS AND DISCUSSION

All of the respondents seemed to be aware of the four core values and their purpose. This probably has to do with the implementation that has been going on in the company, where the employees have participated in workshops about the core values and the desired culture. According to Osborne (1991) acceptance among employees, especially key managers, is important to get positive outcomes from the creation of core values. To be able to get acceptance, a prerequisite must be that people first of all understand the purpose of the values which ought to be the case according to what the respondent said. What could have improved the acceptance further is to involve the employees at lower levels earlier during the formulation of the values.

According to French et al., (2008) one of the important factors is to link actions to values in order to create meaning of the actions. In this way a strong and unifying culture with shared values can be reached. Opinions were ambiguous whether the company had connected the core values to everyday activities on a regular basis or not. The

responsibility for linking values to everyday work tends to rest with each department manager and received indications show that the values are implemented differently. Concerning this matter, it is important for the group executive board to be clear about how important it is that the core values permeate the daily work.

Comparing the findings from interviews with the theoretical framework of organizational culture and core values the paper concludes that the company could do more to address the factors for successful implementation of core values.

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# TOWARDS AN AGENDA FOR USER ORIENTED RESEARCH IN THE BUILT ENVIRONMENT

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*The background for this paper is the authors' participation in user oriented research in relation to the built environment and an aim to provide input to the future research agenda in this area for instance in CIB, who has recently taken an initiative to increase research focus on clients and users. The purpose is to present an overview of different approaches to user oriented research and propose directions for further research that can help to give the users a stronger position to impact the built environment they experience. The methodology is a literature review of research approaches like usability, user involvement in briefing, user driven innovation and participatory design. The different research approaches are presented, analysed, compared, and evaluated. The paper suggests that further research in this field is strongly needed. The different approaches vary in theoretical foundations, methodologies and development, but they are in most cases not incompatible and they use many similar research methods. Further research should focus more on direct interactions with and involvement of users and mostly qualitative research methods should be applied in real life situations or simulations.*

**KEYWORDS:** Usability, built environment, briefing, user driven innovation, participatory design.

## INTRODUCTION

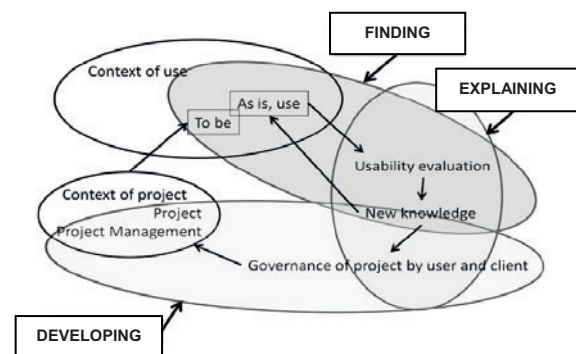
This paper presents current trends in user oriented research in the built environments and outline possible ways forward for research and practice to give the users a stronger position to impact the built environment they experience. It can be seen as an input to support the new CIB W118 Clients and Users, but is also aimed at other researchers, institutions, funding organisations, and practitioners. The starting point is a state of the art of recent research approaches like usability, user involvement in briefing, user driven innovation and user involvement in design.

A recent model from a large collaborative project on usability in the built environment - REBUS - in Finland, Norway and Sweden (Blakstad et al., 2010) is used to map the different approaches of user oriented research. For this purpose we have named the different places in the model: Finding, Explaining and Developing, see Figure 1.

## COMPARISON OF APPROACHES

Eight different approaches of user oriented research were identified. Research in relation to usability was divided in Usability engineering with a focus on individual users of industrial products and IT-software, Usability and accessibility with a focus on individual less able users of the built environment and Usability appraisal with a focus on organisational users of the built environment. Usability appraisal is related to Post Occupancy Evaluation (POE), but is distinguished by a stronger focus on feed-forward to the user organisation rather than feedback to the designers.

Figure 1: REBUS model. Adapted from Blakstad et al. (2010)



User involvement in briefing is specifically related to produce input into building design. User driven innovation is a broader concept coming from industrial product development with Lead user innovation as a specific method. Participatory design is also a broad concept. When relating these concepts to the built environment, it is important to distinguish between conceptual design and the physical design. The conceptual design focuses on the organisational needs of users and search for principal solutions to the configuration of functions and space. Briefing and user driven innovation can be part of this. Participatory design is more related to the physical design process.

The full paper presents these eight approaches and includes a table with a detailed comparison in relation to purpose, typical setting of the user



interaction, the place in the REBUS-model, and stage of development. The five approaches Usability appraisal, POE, User involvement in briefing, User driven innovation and Lead user innovation all take a starting point in Finding and this is the main focus of POE, while Usability appraisal and User involvement in briefing also can include Explaining and Development, just like User driven innovation and Lead user innovation usually cover all three places. The three remaining approaches – Usability engineering, Usability and accessibility, and Participatory design – all have their main focus on Developing.

The development of the user oriented approaches show two completely opposite trends. One trend is towards increased generality where the facilities should be usable for everybody and/or for changing purposes. This is expressed in the demands for universal design and adaptability. The other trend is towards increased specificity where facilities should be usable for specific activities. This is expressed in the focus on for instance optimal learning environments, healing architecture and housing adaptations for elderly. A way to compromise these divergent considerations could be to make the basic building dimensions and common areas like access, circulation and amenity areas as general as possible and make the specific activity areas as fit for purpose as possible.

## SUGGESTIONS FOR FURTHER RESEARCH

The paper suggests that further research in the field of user orientation of the built environment is strongly needed. The literature review shows that the different approaches vary in theoretical foundations, methodologies and stage of development, but they are in most cases not incompatible and they use many similar research methods. Further research should focus more on direct interactions with and involvement of users and mostly qualitative research methods are needed. It is important to distinguish between different types of users and apply methodologies involving users both as individuals and in groups and organisations.

The following list a number of suggestions for future research. The suggestions are listed according to the places in the REBUS-model.

### Finding

Approaches with focus on evaluation of the ‘as is’ situation could benefit from research in the following areas:

- Understanding building clients as organisations (strategic/tactical/operational)
- Role of the users in briefing etc. (REBUS)
- Evaluation of the effects of user involvement

- Management of the processes of evaluating usability (REBUS)

### Explaining

Approaches with focus on creation of new understanding of the ‘as is’ situation and how it can be changed to a new ‘to be’ situation could benefit from research in the following areas:

- Knowledge management of transfer of usability data
- User involvement and tacit knowledge
- Usability briefing
- Investigation of feedback and feed-forward (REBUS)
- IT support of information flows (REBUS)

### Developing

Approaches with focus on creation of a new ‘to be’ situation could benefit from research in the following areas:

- Management of continuous and inclusive briefing
- Briefing as creative exploration of possibilities
- User driven innovation in refurbishing, renovation and housing adaptations
- Agile management of participatory design
- Simulation as method for user driven innovation
- Management of decisions on strategic, tactical and strategic levels
- Management of user experiences

It should be stressed that this paper and these results are part of work in progress and does not intend to cover all aspects of user oriented research in the built environment. Thus, it should be seen as a contribution to the further development of this important area of research.

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# USE OF COGNITIVE MAPPING IN THE DIAGNOSIS OF TOLERANCE FAILURE

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*The management of construction tolerances is a necessary and routine part of the construction activity and is normally brought to our attention only when failures are reported. There seems to be no shortage of experience of the effects of failures in tolerances or of knowledge about how to avoid them. In questioning practitioner experts in this field, the authors identified a misalignment in the perception of 'problem, cause and effect'. In workshops involving experts from various construction backgrounds, the issue of tolerance management and, failures and their causes were examined. The experts were introduced to the concept of fault diagnosis using 'cause and effect' analysis. Experts were then asked to undertake several analyses of their own of preselected failures using a cognitive mapping tool. The purpose of the study is to see how useful the method is among the experts and later be able to identify the root causes to the issues of tolerance management. The results show a possibility to reach beyond the obvious problems and therefore be able to find a new approach in the following steps of the research process.*

**KEYWORDS:** Cognitive mapping, construction tolerances, failure

## INTRODUCTION

This paper discusses a method put in practise for creating an understanding of the problems of tolerance management present in the construction industry. Complications due to misfits lead to delays, increased costs and lack of estimated performance. The method denoted cognitive mapping is used as a general concept for investigating the root causes to previous identified problems. There are a variety of standards, rules and regulations for how tolerances for various building components are determined. The fact is that there are many different values of tolerances, in the industry, resulting the emergence of problems. There are also different standards and regulations for different materials (Meacham 2010). Without adequate controls, education and feedback in the process, it is possible for problems to go unnoticed and to outpace solutions (Meacham 2010). Many times the meetings between different materials, construction nodes, can be complicated. It is common that failures due to lack of tolerance management are adjusted on-sites (Landin and Kämpe 2007). Interface management for different components should be identified and verified to determine how they affect the entire project. This requires an understanding of the project structure among all participants (Yan et. al. 2009). Despite considerable experience of failures due to poor definition of tolerances and the means for overcoming them, problems recur causing further damage and distress. The construction industry has

a tendency to use audits only for correcting defects and not so much for further analysis. To get a better quality in construction, the defects should be linked to an improvement strategy (Johnsson and Meiling 2009). To get a better tolerance management in the process the issues need to be understood at a deep level among the experts in the industry why this research management tool, cognitive mapping, has been used. The current phase of the research involves a series of mapping sessions with individual experts using further examples.

## METHODOLOGY

The method denoted cognitive mapping is used as a general concept for investigating the root causes to previous identified problems. The aim of this method is to gather knowledge and views among the participants in the industry through workshops. The participants were carefully selected people in the industry who have experienced the problem about the management of construction tolerances. Analysis over the causes which the participants raised can then be made. Furthermore correlation among the root causes can later be established and possible solutions to the problem can be found. This study focuses mostly on the use of cognitive mapping and not so much on possible solutions to the problem of tolerance management itself.

## COGNITIVE MAPPING

The use of cognitive mapping has been a growing area of interest among the scientists. Mostly the

technique have been used to structure messy or complex data for problem solving, managing large amount of qualitative data and assisting interview process (Ackerman et. al. 1992 and Edkins et. al. 2007). Cognitive mapping may be defined as a process composed of a series of psychological transformations which is used to elicit those construct in a systematic manner. The method of cognitive mapping is a structured process, focused on a topic or construct of interest, involving input from one or more participants, that produces an interpretable pictorial view of their ideas and concepts and how these are interrelated. The ability to structure, organise and analyse data and visualize this with graphical representations enable both the researcher and the experts/participants together to perceive their own mental models of the phenomena being studied. Thus cognitive mapping not only provide clarity for the researcher but it does also makes the experts aware of occurring schemata and enables them to react and find a suitable direction forward (Eden and Ackermann 1998).

## RESULTS AND ANALYSIS OF THE WORKSHOPS

Four workshops have been conducted. In each performed workshop, the experts draw a map of their analysis over the problem area. During the workshops the participants were divided into groups of 3-4 people in each group. In the performed workshops, the participants were able to see their ideas in context of others. Using this technique in group made the individuals' thoughts captured in a common map. During the workshops, it was noted that the participants found it difficult to both use the guidelines to create a map and at the same time discuss the problem with the others in the group. The guidance is important during the performance why there were facilitators during the whole workshop. When the facilitators noticed that the participants start to go wrong, their task was to lead them on the right path again without affecting their views or thoughts about the problem. This kind of method and mentoring went well for the development of the mapping and how the participants worked throughout the exercises.

## CONCLUSIONS

The maps offer an explicit statement of a phenomenon and have already proven to be useful in discussions with the experts. Moreover, the maps represent a shared understanding of what happens and can highlight where attention to root causes needs to be directed. The different maps give different views of the problem and can also be merge in different ways. By examining the different maps, some common concepts can be found. The analysing of the maps will continue to find different clusters containing various sub-areas

of the problem. It will also highlight similar root causes to the problem. By finding these causes possible solutions to the problem can be identified. With this said; the result show a possibility to reach beyond the obvious problems and therefore as a consequence be able to find a new approach in the following steps of the research process. This is a proven working method for research problems where the interaction with partners in the industry is of great importance.

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# TIME-GEOGRAPHIC VISUALISATION OF STAKEHOLDER VALUES: A CASE STUDY OF CITY RELOCATION

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*Successful construction projects include stakeholder management. However, it still is difficult to communicate stakeholders' interest in the early planning processes of complex building projects due to different stakeholder groups and their conflicting values. The question of how city relocation processes are influenced by stakeholder values is investigated in a case study. Secondary data from municipality public information and two in-dept interviews made it possible to analyse stakeholder's action and their values in a city relocation process over time. A time-interest-power model is developed from the analysis. A city relocation project will be influenced by stakeholder's power and interest. However, power and interests are influenced by the perceived values for the different stakeholders. Therefore, communication is important in order to identify values and needs of the many stakeholders in the city relocation processes. One problem for the decision makers is the development of good communication channels especially with the citizens.*

**KEYWORDS:** city relocation, stakeholder values, time-geographic perspective

## INTRODUCTION

How do stakeholder values influence on city relocation processes? According to Freeman (1984) some stakeholders have a strong influence on society, i.e. legitimate demands and power to use their values when putting pressure on politicians and private and public organizations. For all groups it still is important to investigate if their values, e.g. level of power and interest change over time due to activities related to the specific categories. The cumbersome matter discussed is how city relocation processes are influenced by stakeholder groups over time at different locations.

A model for analyses of city relocation processes is argued to be of interest for project management. City relocation processes we define as the complexity of city planning processes ongoing parallel with design and construction processes conducted by actors. Stakeholders' interest and power is analysed within a case study with the aim of developing a method for analysing stakeholder values with a time-geographic perspective.

## INTERESTS AND POWER

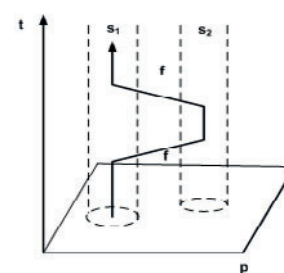
Stakeholders have in theory been identified with different theoretical perspectives. According to Winch (2002) internal stakeholders have an active role in the construction project acting as clients, financiers and users on the demand side. External stakeholders on the other hand, act as architects, engineers, contractors and materials suppliers, on the supply side. Chinyio and Akintoye (2008) argue that it is important to quickly identify key stakeholders in the early phase of a construction project, i.e. those stakeholders with high power and urgency. Another perspective is based on

stakeholders' interest and power in the project or organisation presented by Johnson and Scholes (1999). Olander (2006) argues that external stakeholders influence the construction projects in different ways due to their level of power and interest.

## STAKEHOLDER VALUES

According to Barrett (2007) stakeholder values should be managed and balanced in the building processes. Managing stakeholder values also gives an understanding of the business concept according to Saxon (2005). For all stakeholder groups it still is important to investigate if their level of power and interest change over time due to activities related to the specific categories. In Figure 1 individual actions are illustrated by stations in time (t) and space (p) by defining two stations indicated by S, which may be for example a home and a school (Hägerstrand, 1970). The thick line **f** is a trajectory of an actor, leaving S1, visiting S2 and returning to S1.

Figure 1: Stations in time-space Source: Hägerstrand (1970).

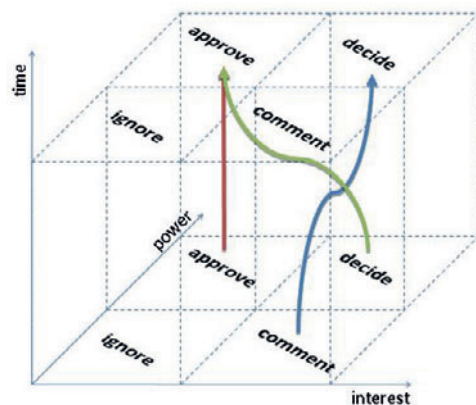




## A STUDY OF CITY RELOCATION

The case of city relocation processes in Kiruna, a city in the Northern Part of Sweden, has been selected due to its complexity. Data has been collected from interviews and from the municipality's public information. The results from the analysis show that stakeholders have different roles in the city relocation process closely related to their power and influence in accordance with previous studies. Our analysis has resulted in defining the role of stakeholders and their change over time as key players acting as decision makers; stakeholders kept satisfied are giving their approval to the decisions; stakeholders kept informed are giving comments to decisions and stakeholders with minimal effort are ignoring the city relocation process and its decisions. Figure 2 presents our time-interest-power model. The model is developed by combining the time-geographical perspective with the interest-power stakeholder map developed by Johnson and Scholes (1999).

Figure 2: Results from analysis within the time-interest-power stakeholder map.



In Figure 2 the colored trajectories are examples of how stakeholders influence the city relocation processes due to their values based on roles and how these roles change over time. The green colored trajectory illustrates the process of one stakeholder, the energy company. This stakeholder had a role of making decisions in the early phase, i.e. in the planning processes of the city relocation, due to their business concept and values. They conducted a specific project and when it was completed the stakeholder changed role from decision maker to an approver.

## CONCLUSIONS

An analysis of stakeholder power and interest, driven by values within a time-geographic perspective has been presented. The time-power-interest model is used to visualize and explain how

different stakeholders' interest and power change over time due to stakeholder values. Our main conclusions are that when relocating a city, stakeholder roles influenced by their power and interest are not only related to specific activities and construction processes, they are also related to stakeholder values. Thus, it is important to make these values transparent for the decision makers through proper communication. One of problem discovered for the decision makers in the case study is the development of good communication channels especially with the citizens. Little feedback was found from this group in the secondary data. The potential benefits of including these stakeholders groups are therefore high. To support communication and decision making processes needs information of future activities, both in and time and space, to be disseminated to all stakeholders. This is a major challenge in the city relocation project studied, where the power-interests map is continuously changing over time. Therefore time-space information needs to be created, shared and used in a simple and efficient way to handle the different stakeholder's values, power and interests.

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# THE BUILDING SYSTEM AS A STRATEGIC ASSET IN INDUSTRIALISED CONSTRUCTION

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*The growing industry segment within construction focusing on industrialisation, meet new challenges traditional construction firms never have encountered. The choice of a building system (technical and process platform) defines not only what resources and technology are needed, but also the organisation within the company, its market position, and possible growth. Using a resource-based view, the building system can be seen as a strategic asset for an industrialised construction company. In this paper, the characteristics of a strategic asset is identified and used to analyse two building systems as being a strategic asset at two industrialised construction companies in Sweden. Two companies participated in the case study, one specialised contractor and one more general contractor, both active in the housing segment. The building system is clearly a strategic asset in all aspects for the specialised contractor, while the asset for the general contractor lies more in the organisational power of the company than in the technical solutions. The company strategy should therefore differ. The specialised contractor should strive to clarify and strengthen their total offer to the client, while the more general contractor should continue to exploit its human resources, moving towards a more unique offer to their client.*

**KEYWORDS:** industrialised construction, building system, strategic asset, technical platform, process platform

## INTRODUCTION

The development of a more industrialised approach challenges the flexible and temporarily organised construction set-up by using production lines to organise a more steady flow creating economies of scale (Gibb 2001). The actual resource (the building system) is the method used to fulfil a need on the market and contains a physical solution to the problem, an organisation to sell, produce and deliver the physical solution and a continuous build-up of experience in people and organisation (Söderholm 2010). The aim of this paper is to describe the building system as a strategic asset and thereby gain knowledge on the companies' competitive advantage.

## THEORY

Based on the resource-based view for company competitiveness, Barney (1991) suggested four properties that characterise a strategic asset or critical resource, table 1.

Table 1: Characteristics of a strategic asset to create heterogeneity and immobility leading to a sustained competitive advantage

Rareness	Imitability
Substitutability	Value

Strategic positioning on a market has become increasingly important due to rapid changes in the construction industry's business environment (Junnonen 1998). Construction is a business with

high uncertainty (Winch et al. 1998) and a dynamic technological environment, favouring a strategy with organic structures that are flexible and low in task specificity. This has led to a focus on effectiveness in separate projects, which is very different from nurturing a strategic asset. Industrialised construction often incorporates the ownership of resources e.g. machines, factories, and personnel (Gibb 2001). These resources are labelled a building system and organised to produce certain results, not to be as flexible as possible. Using the resource-based view to describe firm strategy could identify the building system as a strategic asset and then develop the firm's core competence (Flanagan et al. 2007). The strategic assets support one or several of a firm's basic capabilities; the innovation, production and market management capabilities (Rangone (1999)).

## METHOD

The empirical data is deducted from two cases in the Swedish building industry. The study incorporates two companies; Lumi: 'one company – one building system with large integration' and Noin: 'one company – several building systems with less integration'. Data were collected through interviews, workshops, and archival analysis. The analysis was made by confronting the theoretical framework of a strategic asset with the two cases. The cases were described using their basic capabilities; innovation, marketing and manufacturing (Rangone 1999).

## THE CASE OF LUMI

Lumi produces multi-family dwellings constructed of volumetric modules stacked up to six stories high. Lumi is an SME and specialises in multi-family dwellings and their strategy is to take wholesale responsibility of the client from sales to completed building through design-build contracts. Lumi nurtures one building system and the entire company is organised around it. Product development is a gradual activity performed partly within building projects and partly in development projects, but always directed to support and spread the building system. The sales department has built up a large contact network with returning and potential clients. Lumi has signed long-term contracts with one of the largest clients in Stockholm. Factory production is partly automated and the design department produces computer files that control the nailing portal. In the factory, building projects pass in sequence, but in the design process between 5-15 projects are concurrent.

## THE CASE OF NOIN

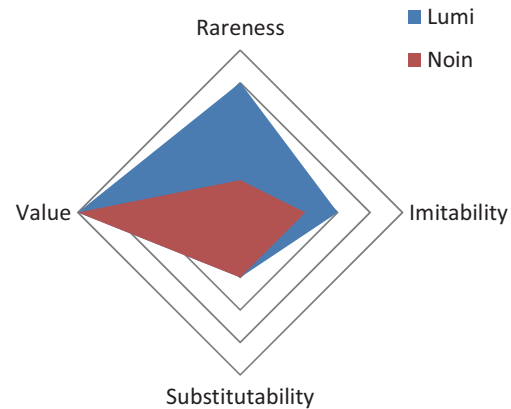
Noin produces multi-family houses, but also possesses a wide range of other production capabilities such as civil engineering and commercial buildings. Noin is a large size company. The ability to solve almost any problem is part of the company strategy, but lately Noin has begun to organise design and production in technical platforms, but without investing in equipment. Noin sustains several technical platforms at the same time, one is the housing platform. Noin's contact network on the construction market is vast and Noin is almost always a contender in open bidding in Sweden. They are often invited to place bids and are attractive as partners when developing new solutions together with clients. The building systems used by Noin are developed by a specialised division of technical. The basic technology for housing is prefabricated flat concrete elements, delivered to the site from a material supplier. The company does not own the factory where the elements are produced. Instead they own the design process and the assembly process on-site.

## CASE ANALYSIS

The rareness of the building system is much higher with Lumi than with Noin, figure 1. Lumi produces a building system only few other firms provide, while Noin buys their building system parts on the open market. The technology used by both companies is easy to imitate, what is more difficult is their historical context and contact network and their Lumi has a stronger position in the particular niche of housing. The building systems are substitutable for one another and deliver great value to the clients although in different ways. Lumi offers a turnkey solution, while Noin

provides good capabilities for managing unexpected situations.

Figure 1: The four characteristics of a strategic asset for Noin and Lumi.



In conclusion, the building system is identified as a strategic asset with Lumi, but not so strongly with Noin. Noin would need to focus more strongly on increasing rareness to increase their competitive advantage in comparison to other firms.

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# STATE OF THE ART IN SUSTAINABLE FACILITY MANAGEMENT

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*The European Union is targeting a sustainable development of the economy. Therefore it is important to develop better technologies and better management. Facility Management can contribute to a sustainable development of the built environment with regard to the interaction between companies and their business surroundings. This is because of its responsibility for the integration of primary processes and support processes within organizations. Facility Management influences the procurement and delivery of construction in direct and indirect ways. Direct influences on the sustainable development of the built environment are seen within the three main areas of responsibility: support of "primary processes", development of "space and infrastructure", and development of "people and organisations". Facility Management contributes indirectly to the overall objectives of sustainability concerning society, the environment and the economy. A review of the international literature in Europe in particular of scientific publications revealed up to now no common definition or consistent application of the term "sustainable facility management" in Europe. Therefore a preliminary SFM-model was developed and discussed in expert workshops.*

**KEYWORDS:** Facilities Management, Built Environment, Sustainable Development, Sustainability Strategy, Europe

## INTRODUCTION

Sustainability has gained increasing importance for Facility Management in practice, education and research. Buildings, constructions and facilities must be tailored to suit the company's need to maintain profitability and achieve business growth. The construction, operation and usage of buildings require a lot of energy and resources. Sustainable business development can be achieved with enhanced technology and better management methods. Facility Management in particular can sustainably shape the interdependency between the built environment and the business environment, because FM adds a special area of responsibility at the interface between the companies' core business and the accompanying secondary business processes.

## THE SCOPE OF FM

The scope of FM has been broadened from the purely technical matters, i.e. the smooth operation and maintenance of facilities to overall real estate management over the last 10 years. Rondeau puts in a nutshell as follows: "In a number of organizations Facility Management has moved from the boiler room to the board room." (Rondeau 2006, p. 554). Scandinavian research engineers have compiled a "facility management value map" which measures the added value produced by FM. Taking account of its use of resources, its processes and products, and its influence on the environment and on companies' core processes. (Jensen et al. 2008, p. 297)

Moreover, a clear trend in Facility Management is visible: FM is extending its scope from a single building to the building peripherals and the built environment: Facility Management is on the move!

The international literature research resulted in 195,534 matches for „Facility Management“ and 5,326 for "Sustainable FM". The publications covered in WorldCat are mainly American. The query in the European union catalogue resulted in 3,573 matches in the „Facility Management“ category. American publications in the Facility Management sector far outnumber European publications.

The preliminary SFM-model was developed in two steps:

1. Awareness of sustainability means to be aware if and how Facility Management impacts are sustainable. The organization's surroundings become the focus of observation. What impacts on society, the environment and the economy are noticeable? How can sustainability be assessed in social, environmental and economic criteria? Up to now a comprehensive SFM assessment tool is not available. Existing systems can be used in some cases. For example the US Green Building Council (USGBC) has published a guideline which is suitable for the assessment of existing buildings: „LEED 2009 for existing buildings operations and maintenance“ (LEED-EB 2009).

2. Integration of Sustainability targets the development of sustainable organizations through the integration of sustainable targets. After the basis of sustainable Facility Management is established and assessment targets and measurement categories are defined it is possible to view the whole system from a higher level. Gaining a perspective from outside the whole system makes it easier to see how the organisation interacts with its surroundings. The task is the integration of social, environmental and economic targets within the business strategy in Facility Management. The sustainable organization can be considered as one component of a sustainable society.

FM has been defined as direct impact between companies' core processes and two categories of supporting service processes: 1. Building space and technical infrastructure; 2. Employee and organizational processes. Furthermore, the indirect impact on the environment, society and the economy has been described. FM influences the interdependency between the company and its environment, including the companies' real-estate asset and infrastructure related constructions, which are also known as the built environment. What still needs to be discussed is, how FM can contribute to a sustainable development. Possible assumptions are that FM can enhance this development directly through its improved use of resources, FM processes and applied FM products as well as indirectly through its influence on the economic, social and ecological environments.

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# INDICATORS FOR BUILDING PROCESS WITHOUT FINAL DEFECTS – METHODOLOGY AND THEORETICAL FOUNDATION

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*This article introduces the preliminary data analysis, as well as the underlying theories and methods for identifying the indicators for building process without final defects. Since 2004, the Benchmark Centre for the Danish Construction Sector (BEC) has collected information about legal defects in connection with Danish construction enterprises that have been handed over. The project aims to utilise the knowledge potential available in BEC's database in order to locate key performance indicators of construction failures and defects. The empirical data from BEC is applied in a more academic context than has been the case until now. The idea is to survey which indicators differentiate good construction and processes of construction from bad ones. The method is a retrospective analysis, which is based on data on the handing over. The data used has been partly that which BEC has already collected and partly additional focused data collected through interviews and electronic questionnaires directed to developers, designers and contractors. The first results from the data collection will be available in spring 2011 and will be able to indicate the differences between construction without or with only a few defects and construction that is handed over with many and serious defects.*

KEYWORDS: Failure and defects, Construction, Best practices, Indicators

## INTRODUCTION

The Benchmark Centre for the Danish Construction Sector (BEC) is a business foundation established by a broad circle of parties from the construction sector in order to promote quality and efficiency. The Centre's function is to collect and organize information and evaluations from the parties involved in construction projects. The collected data is used to calculate key performance indicators. The type of defects, deficiencies and failures registered in BEC are of a legal nature, i.e. the discrepancies registered by the client following delivery, also where there is a lack of correspondence between what has been delivered and what was agreed upon by the customer and the supplier (the client and the contractor).

All governmental buildings and all publicly utilised buildings will be evaluated; all other buildings may be evaluated by BEC. The motivation for being evaluated is that the public contractors begin to pay regard to evaluations in their tenders. January 2011, BEC has collected data for approximately 2,200 completed construction projects within the period from 2004-2010 and is thus the largest Danish register over evaluated buildings. Information is submitted by the building owner and the contract manager, respectively, where it is made certain that the two parties agree upon the details. In this way, a high degree of validity and reliability are ensured in the given details.

BEC's data provides the basis for identifying construction projects delivered with few legal discrepancies and those with many. The project Indicators of construction without failures and defects investigates what differentiates these construction projects, with the aim of identifying the indicators that lead to few discrepancies. Indicators, refers to the characteristics of a building project that can have direct influence on the discrepancies found, even though they do not directly explain their causes. Such indicators can be the way bids are made, organization, experience, coordination, form of cooperation etc.

The factors that various researchers in building processes have found to be problematic are factors for which it is relevant to investigate whether they are indicators for a successful construction project or not. This leads to the following hypotheses:

BEC's data for registered legal deficiencies at delivery of a construction project provide an indication of whether a construction project and process have been good or bad; thus, such indicators can actually be used to tell us something about the quality and robustness of a given construction project.

It is possible to find generic differences in construction projects and building processes, which



can be identified by the level of legal deficiencies at delivery.

The indicators that have been found to influence robustness in safety and risk research are also relevant for robustness in relation to quality.

It is possible to recreate and rediscover such indicators in a retrospective investigation in which the empirical data must be based on interviews and historical statistical data.

The methodological questions to be answered in this article are:

1. On the basis of BEC's data, how can we define which construction projects are good and which are bad?
2. Which indicators shall be included when identifying the indicators of construction projects that are defect-free?
3. What theoretical foundation and methodological procedures can be used to identify these indicators?

The types of indicators sought are partly those that can support the hypotheses and partly those the literature indicates as significant to the good building process. This is divided in themes like 1) economy and time schedule, 2) Coordination and communication, 3) Planning, management and quality, 4) The interested parties competences and experiences, 5) Working environment and new technology, 6) Quality culture.

Identifying the indicators for the good building process and their significance for the scope and seriousness of defects at delivery should be able to be accomplished through combining a quantitative survey with a subsequent qualitative investigation, where the results from the quantitative survey are investigated in depth. This will make it possible both to carry out a study with statistical analyses of indicators, and a case-oriented description of how the same indicators function and are related to concrete construction projects. The quantitative survey, for reasons of time, will be a retrospective study of finished and evaluated construction projects. In order to ensure that respondents can remember the building process, the survey will only include projects completed within the last three years. Thus, the empirical study includes only evaluated construction projects from the years 2007-2010, as per October 1, 2010.

## CONCLUSIONS

The article presents proposals for how to identify indicators for the good building process, which is

characterized by delivery on time and without defects. The point of departure is evaluations of construction projects during the period 2004-2009, carried out by Benchmark Centre for the Danish Construction Sector (BEC, 2008). The method is to collect supplementary information based on a quantitative survey and a qualitative investigation regarding indicators, in order to discover whether they contribute to building processes that lead to no or only few defects at delivery. The article describes this method; however, the results from the survey are not yet available. The method's use of BEC's data of evaluated construction projects can be discussed, as well as the considerations about the method for collecting and analyzing indicators.

## ACKNOWLEDGEMENTS

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# INVOLVING END-USERS' EXPERIENCE AND AWARENESS: USING BOUNDARY OBJECTS IN BRIEFING

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*This paper addresses the process of briefing, wherein the translation, transformation, and absorption of information about needs and requirements is transferred from client to architect. The aim of our work has been to test and develop boundary objects, involving users in briefings to gain a higher level of common understanding between the actors. Our hypothesis is that end-users' experiences and awareness of how they work within and utilize space are essential in developing new workplaces. The chosen methodology is an explorative case study, limited to and conducted as action research in a briefing process related to a new office solution in a Norwegian context. Different tools, methods, and artefacts were used and tested in order to understand the work processes, cooperation, and relationships between the users. The purpose was twofold, namely to enrich the information to be transformed in the brief and to test the effect of some forms of boundary objects which served as temporary bridges during the translation process, enabling equality in agreements and common understanding between the actors involved. The research contributes knowledge of how different forms of boundary objects affect a briefing process, involving users in the action.*

**KEYWORDS:** briefing process, end-users' awareness, actors, boundary objects

## INTRODUCTION

Workplaces are constructed to support users when performing their individual and collective activities. Theory and practice in workplace design highlight the importance of involving end-users and their experiences in briefing and workplace design (e.g. Kernohan et al. 1992, Horgen et al. 1999, Våland 2009, Blyth & Worthington 2010). Our hypothesis is that end-users' experiences and awareness of how they utilize space are essential in developing new workplaces.

In this paper we present a set of boundary objects, different tools, methods and artefacts, that has been developed to aid and facilitate the communication, translation, negotiation, and interaction between the demand side (i.e. users and user organization) and the supply side (i.e. consultants developing briefs and designs). The boundary objects were developed and used in an experimental case study, conducted as action research. Our research objectives were to:

- Develop and test a set of boundary objects for user participation in the briefing for new office buildings
- Investigate how boundary objects impact on users' experiences and awareness of their needs and of their present and future workplace.

## Participatory perspective on briefing

Whenever an organization's work processes change, the workplace may be rethought to fit the shift, and hence a demand for change in the physical environment may emerge.

In order to provide a systematic and controlled process during stages in a project, good briefing implementation is the key to avoid expensive mistakes or inferior results. According to Blyth and Worthington (2010), good briefing relies on a dynamic interaction between individuals and teams in organizations, and is concerned with the communication and management of information within and between them. Another important aspect of end-user participation is that it may become as much a significant process to the employees as to the leadership rendering ownership and engagement (Fristedt & Ryd 2004). By engaging end-users in active participative roles in the briefing process, in which they can exchange experiences as experts in own work processes, their engagement will grow parallel to their awareness.

## Boundary objects as bandwagons

To ensure a good balance between participants in dialogues and negotiations in a briefing process it is necessary to resolve any dilemmas that actors face in participatory processes. The concept of boundary objects contributes by de-emphasizing the distinctions and the imbalanced power structure between the actors with initially different skills and cultural background, interests, and points of view

(Star 2010), contrary to ANT (actor-network theory), which focuses on the imbalance of power that often occurs between participants in a translation process (Latour 1987).

### Research methods and design

The chosen methodology was an explorative case study, conducted as action research and carried out between December 2007 and November 2009. The case was the briefing process of new workplaces for OpCentre, which is an operation centre located in mid-Norway, with responsibility for safe railway communication on all national railway lines. Due to the demand for more space, the leadership of the operation centre wanted to take the opportunity for change to focus on how a new office solution could support their present and future work processes, knowledge sharing, and teamwork among the staff.

### Boundary objects used in the participatory process

In the briefing process of OpCentre we wanted to use the concept of boundary objects to capture tacit knowledge about work processes among the individuals and user groups and give equal status to the qualitative and quantitative data information as useful in defining the brief.

We identified three different purposes and sub-processes: enhancing awareness, defining objectives, and constructing concepts. The resulting set of methods was used because they were believed to have the potential to serve as boundary objects which could be developed during the briefing in interaction between different user groups and researchers.

Figure: Some of the activities that became boundary objects. From left to right: C. – Description of current individual work processes; F. and G. – Characteristics of individual and collective workplace, respectively; H. – ‘The impact of the building’ for the company;



### CONCLUSIONS

The users became more aware of their own situation, the goals, and needs. They developed a common understanding of the organization and became engaged on a higher level than in most briefing processes. The activities and iterations became shared representations with interpretive

flexibility, and enabled the users to uncover and identify invisible knowledge about work processes that were embedded. Hence, these shared objects appeared as boundary objects which facilitated the participatory process, the users' discussions and negotiations, and enabled agreements between the users, between the researchers and users, and between the architect and users. This enabled the users to have an equal position in negotiations and to take a leading role in stating the needs and in impacting, adjusting, and coping in the design and construction process.

The user participation in the process was extensive, and there is a need for further work to identify the most effective boundary objects, producing the best results with more limited use of time and resources. There is also a need for further investigation of the OpCentre case, evaluating the effect of the workplace in use. The planned post-occupancy evaluation will be the final test to see whether the objectives have been met.

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# DESIGNING CLEAN

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*Consulting Engineers and Architects riding on the climate mitigation wave, are currently experimenting with the concept of “Integrated Design Process” (IDP). This paper views “Integrated Design Process” along with other management or organisational concepts, seeing them as less of systematic knowledge and more of a symbolic device for enabling change. The paper acknowledges a number of international variants, but concentrates on three variants present in Denmark: an architect and engineering variant of IDP and an Integrated Design Organization. The differences between the concepts include perception of main actors, the role of information technology, the relation to lean, and forms of collaboration. Furthermore the focus of the variants differ (industry, organizational or project level). The paper discusses case studies of four teams of engineers and architects. It is argued that there exist (only) several ambiguous concepts of IDP, none well defined, and the architects and engineer struggle with the concepts even when directly involved. Precarious and negotiated consensus has to be created. The various players agree that an increased interdisciplinary interaction in the design team is necessary in order to comply with the increased complexity of sustainable building design. This tendency changes the traditional roles and responsibilities in the design process.*

**KEYWORDS:** Integrated design processes, sustainable building, Denmark, negotiated concepts

## INTRODUCTION

One of the central impacts of designing clean buildings is that energy consumption concerns and energy related requirements pushes themselves “upwards” in the design process to the early conceptualization phase. This paper focuses on the use of “Integrated Design” (IDP) on cases which involve architects and engineering consultants and for other reasons even contractors. The paper’s empirical material encompass two building projects both aiming at going beyond the EU-requirements for energy consumption. At each of the two projects, two competing project teams, were interviewed addressing architects and consulting engineers. And also referring to clients and contractors representatives. Here only two team’s responses are described to illustrate the process and all four teams responses are encalculated in the analysis.

## Method

The theoretical approach taken is multidisciplinary, with interpretive sociology as a central position. The paper open with identifying internationally present versions of IDP, as a background for characterizing three versions of integrated design present in Denmark. This part of the paper built on desk and a selective literature study, both identifying research based and more popular versions of the concept (Koch et al 2003). The paper’s empirical part builds on case studies of four teams participating in a competition on two building projects (Haubjerg, 2010). The choice of cases was done with point of the departure of a collaboration of Haubjerg with a consulting

engineering company. The names of the two competitions “Zero Carbon” and “Mountainview” are fictions. Below the process is focusing on the two teams of Mountainview.

## Theory

IDP is viewed as a management concept, implying that the concept is thought of as a loosely bundle set of ideas, visions, processual and content tools, exemplary cases and results (Koch et al. 2003). This stands in contrast to a belief that concepts used in enterprises would be founded on scientific systematic knowledge, and encompass well defined and explicit tools

## Integrated Design

Concepts of integrated design have been around for some time and are present both in academic literature and in companies’ branding of competences etc. The focus on integrated design (without processes) is for example presented by Moe (2008). He understand integrated design as what architects do, when they incorporate the energy, site, climatic, formal, construction, programmatic, regulatory, economic, and social aspects of a project as primary parameters for design. Moe’s concepts are clearly aimed at mitigating climate change.

## Danish Variants of IDP

Three variants of IDP are identified, an architectural-oriented (Hansen & Knudstrup 2007), an engineering-oriented (Petersen & Svendsen 2007) and an organisational. All three variant are embedded in more than one player in Denmark,



both encompassing industry companies and universities. The architectural oriented variant is developed at the Department of Architecture and Design at Aalborg University, Denmark (Hansen & Knudstrup, 2005). It is based on a holistic architectural approach and advocates a close collaboration between architects and engineers. One of the fundamental tools in this approach is a comprehensive parametric analysis that allows the engineers to be more proactive in the design phase. The approach operates with four phases: Analysis, Sketching, Synthesis and Presentation. The engineering oriented variant is developed by Petersen & Svendsen (2007) at the Technical University of Denmark (DTU). It is based on designing rooms before buildings in a “space of solutions” where each room is analyzed in accordance to predefined goals regarding energy performance and indoor environment by the engineers. The architect can then design the building by combining the rooms in various ways based on the performance of the rooms (Petersen & Svendsen 2007). It is thereby possible to design various buildings that automatically fulfil the predefined performance goals.

### **Cases Project Zero Carbon**

Project Zero Carbon concerned a medium sized building (5,000+ m<sup>2</sup>). The client's requirements to the building's energy performance were tighter than what is required in the Danish building regulations (and EU regulation) and the client was focusing on facilitating IDP. The client arranged an invited project competition for five selected parties with duration of roughly 3 months. The client was represented by 3 partners: a contractor, the municipality, and a consultant. After awarding the winning team, the project carried on as a traditional design build contract in collaboration with the contractor as the main contractual reference point for the architects and engineers. Out of the five prequalified teams, two project groups were chosen as cases, one of them was the winning team. The project teams consisted of a main architect, a main consulting engineer, and various sub consultants and specialists. The interviewees were the main architect and the main engineer from both teams

### **Cases Project Mountainview**

Project Mountainview concerns a large scale building project (30.000 + m<sup>2</sup>). The client invited selected companies to a Design/Build competition with duration of approximately 3 months. The client is represented by 3 partners which all are future users of the building. The project's requirements concerning energy performance was also tighter than required in the regulations though there were no specific initiatives regarding facilitating IDP. Like in project zero carbon, two of the prequalified teams were chosen. When the

interviews were conducted the client competition committee was still deliberating.

### **Analysis**

The interviewed actors have difficulties defining what integrated design “is” even after having participated in a process claimed to be governed by the concept. For example in Mountainview team 1, the engineering consultant views EID as IDP, whereas the architect distinguished between them. In one team, engineers appear to stick to evaluation through IT-models of the ideas of the architects. There is thus a relatively weak performance of IDP as all kind of process experiences and practices get mingled in. Possibly IDP “works” more through providing a philosophy of interactive collaboration.

### **CONCLUSIONS**

The analysis shows that there exist (only) several ambiguous concepts of IDP, and the architects and engineer struggle with the concepts even when directly involved. Precarious and negotiated consensus has to be created. The various players agree that an increased interdisciplinary interaction in the design team is necessary in order to tackle the increased complexity of sustainable building design. The cases studied represent clients willing to go beyond present day building regulation. This implies that the design teams embark on less well defined ground in setting the environmental level in the design, balancing it with criteria such as cost.

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# UNDERSTANDING THE STATUS AND DEVELOPMENT OF BUSINESS NETWORKS FOR CONSTRUCTION OPERATIONS

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*Various business networks in the context of temporary projects require special attention also from the managerial viewpoint. Such networks are of strategic importance and thus they should be monitored and maintained systematically. Practical tools for this purpose are rare or do not exist. A specific tool is proposed for estimating and communicating the degree of formal and informal relationships with regard of different networks on focus. Additionally, for future operations and network development new type of so called broker centred business networks are proposed as a new instrument that would help companies to be more agile and reactive in dynamically developing markets.*

**KEYWORDS:** business networks, international construction, construction companies, management, Russia

## INTRODUCTION

Business network as a term has a rather broad coverage and it has a wide usage in spoken language rather than as a specific carefully defined concept. We use the term business network as a general reference to variety of networks enabling the creation and execution of business operations.

Global internet enabled electronic-commerce, resources and financing opportunities have created new business environment where business networking is essential for all lines of businesses. Thus the business networking, its management and relating research have been very popular topics in different research institutions and provided also sources for consultative operations. The research and empirical evidence from live business operations have provided grounds for improved knowledge on business networking. Examples of such studies are (Benkler, 2006; and Friel & López, 2005).

Table 1. Categories of business networks and their control for the visualisation of those with traffic lights.

TYPES OF BUSINESS NETWORKS	Degree of formal relationships	Degree of Informal relationships
<b>Uncompelled Business Networking</b>		
1. Long-term business network		
2. Short-term project network		
3. Business breeding networks (casual-contact networks, Virtual Breeding Environment)		
<b>Technology enabled Business Networking</b>		
4. Online networks (Collaborative Innovation Network, sales network)		
<b>Service oriented Business Networking</b>		
5. Service organizations (consultants, local agents)		
6. Professional associations (knowledge networks)		
7. Social/business organizations		

Table 1 presents a synthesis of various main types of business networks that have been identified by researchers. One should note that research community prefers to use term Inter-Organizational Relationships (IOR) since this as a term is more precisely expressing the phenomenon in question.

## RESEARCH RESULTS AND INDUSTRIAL IMPACT

The adopted leading business network vision is the movement from traditional business networking towards more agile solutions enabled by new goals and roles. Business networks and networking should not be only understood as a managerial focus area that needs additional attention. Furthermore new kind of activities and organizational arrangements are required for capitalizing the all potential business advantages arising from networked operations.

Virtual business networks are seen as a breeding that provides highest needed flexibility

- To have preparedness of participating players to set up a virtual organisation (VO) to meet market challenges
- To have different levels of commitments and rules in place than in a traditional, and more rigid, type of business networks.

Example of such virtual business networks are presented in the following chapters.

## BROKER CENTRED BUSINESS NETWORKS FOR SALES

Business networks can be formed by opportunity brokers that detect appropriate business opportunities. The following figure shows an example of a Public Private Partnership (PPP) broker that helps in both setting up the customer system to the public demand side, and then

connects that to the supply system built up in the delivery side.

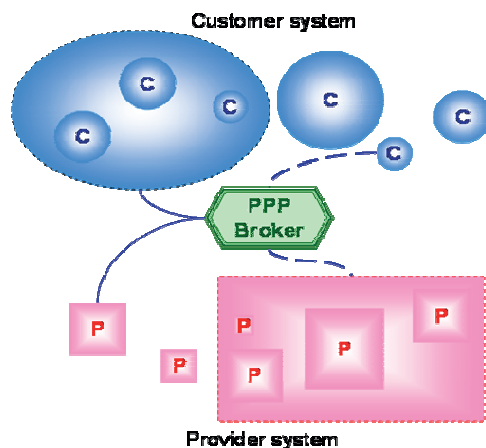


Figure 1. PPP Broker.

### VIRTUAL DESIGN NETWORKS

In construction, customers may have specific service needs that can be provided by number of scattered small firms with specialized competence. The main contractor is often responsible for the design to the customer. Managing a network of specialized design firms can be run by a broker, having skills in managing a virtual design network.

The Subcontractor Broker creates and manages the virtual design network for the main provider, e.g. the main contractor that owns the customership (figure 2). Such broker can manage also some functions directly with the customer if that's required. The main provider outsources the subcontractor design network management to focus on customer relationship management and service innovation. The broker needs to have expertise on the VBE network ecosystem elaboration and management, project management, virtual organization management and legislation.

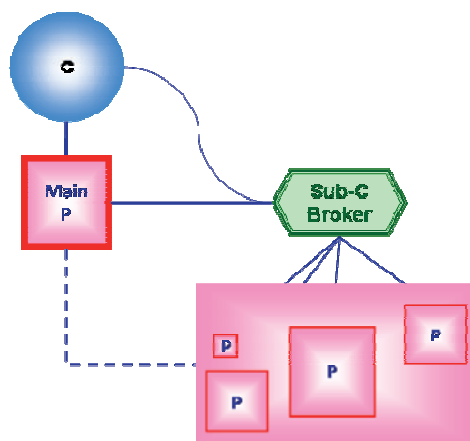


Figure 2. Subcontractor management Broker

### CONCLUSIONS

The field of Inter-Organizational Relationships that is often referred as business networking has clearly elaborated during last decade into a disciple of its own. At the same time and particularly as a impact of Internet enabled eBusiness new dimensions and concepts have arisen in this field. Perhaps the most important of those is the Virtual Organization concept and its applications.

Researchers have found that the concept of virtual organization (VO) appears particularly well-suited to cope with very dynamic and turbulent market conditions. This provides origins of some important proposals presented in this paper. It is considered that new kind of business networks which have been named as broker centred virtual organizations can play important role for construction business operations in Russia in near future. However, one should take into account local cultural factors that can broadly affect of the creation and maintenance of these networks.

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# DISSATISFACTION FACTORS IN THE INFRASTRUCTURE PROJECTS-PROJECT FEEDBACK APPROACH

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*Soft performance measurement tools, such as customer satisfaction and cooperation between parties have been received a lot of interested in construction industry in the recent years. This paper examines infrastructure project performance through different parties: customer, project consultant, designer, and general contractor. This is done by analyzing results of a web-based mutual project feedback system (ProPal). Total amount of collected feedbacks in the data is 495. The goal of the study is to examine and analyze dissatisfaction factors in the infrastructure project assessed by the main parties in the construction project. The main finding is that designers' performance was evaluated at the lower level than others. This might be a consequence of that designers have to deal more entireties and the final end product, in contrast to contractors and project consultants.*

**KEYWORDS:** customer satisfaction, key performance indicator, project management, infrastructure project, performance measurement

## INTRODUCTION

The importance of satisfied customers and smooth cooperation between parties has been recognized in the construction industry one of the main challenges. The construction industry has been widely accused of the poor performance and its unsatisfied customers e.g. Egan (1998). However, since Egan's reports, soft measurement tools such as customer satisfaction have been introduced little by little in the measurements of project success (Chan and Chan 2004).

Infrastructure projects are complicated and every project is unique. Main parties of the projects are changed with each passing projects which means new interrelationships all the time. Short-term interdependencies don't support satisfactions and confidences between the project stakeholders. In many cases, this has affected the project delivery harmfully.

The literature of the soft measurements as an indicator of project success has been focused merely on the customer – general contractor relationship. However, project participants' satisfaction to project has been found also as an important aspect of project success. There is also lack of proper information about how different parties in the construction assess their mutual performance. This information can be used as a tool for developing construction processes and mutual learning.

Initially, this paper presents overview of the dissatisfaction factors in the infrastructure projects

as assessed by the main parties in the construction project.

In a project environment, it is essential to that project feedback should cover the most important parties in the supply chain and be bidirectional (Kärnä, 2009). In order to attain the project goals, a systematic evaluation of the organizations' performance is required to provide feedback for guiding the participants' behavior (Liu and Walker, 1998). Because the performance of each participant in the construction project coalition is interdependent, other participants should assess their performance. It is also well known that the poor performance of one party will affect the performance of the next party (Kanji and Wong, 1998).

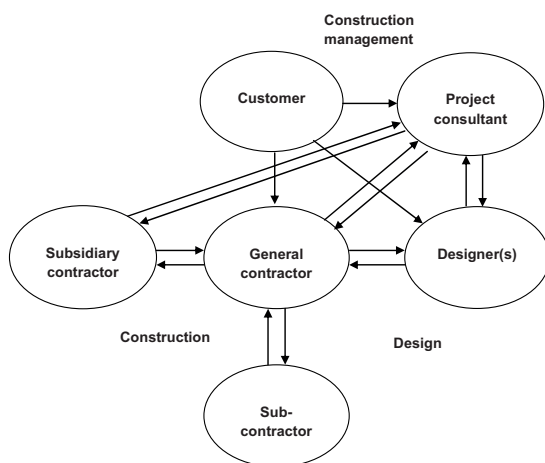
## Propal-project feedback system

Data for this study were gathered by Propal-project feedback system, which was recently developed in Finland to improve customer orientation and quality in the construction industry. ProPal-project feedback system is a technically developed and versatile feedback serving the whole industry and it is operated by Finnish Construction Quality Association (RALA).

With the help of the feedback system, the various parties can observe the essential needs for development and target the necessary actions. Objective of using the system is that through openness and mutual learning, cooperation between parties will develop and the customer orientation of the entire industry is improved.

Thus, the project feedback system enables using 15 different questionnaires in where various actors assess the operations of each other. In the feedback system, the questions are formed as statements and connected to a scale where answer (1) describes the operations very inaccurately and, correspondingly, (5) very accurately. The basis for the contents of the questions was formed by the various tasks in construction and the requirements they set for a construction project. Feedback flows of the system are presented in the Figure 1.

Figure 1: Feedback flows in the Propal



### Research design and results

Totally nine main feedback flows were chosen to best suit purpose of this study. These feedback flows cover the main tasks in the construction: construction management, construction and design and also the feedback of the main parties: customer, project consultant, main contractor and design team.

In general, according to the research relations between the parties related to design seems to have more dissatisfaction items than in the other relations. Exceptionally, in the feedback flows, where the customer gives feedback to others - in this feedback flow designers' performance was assessed the best in the data. Firstly, this might be due to customers' distance to the project management and construction phase. Secondly, we assume that customers have had strong impact on plans.

Designers' feedback to project consultant has had rather high levels of dissatisfaction. Dissatisfaction factors in this relationship are related mainly to project consultants' ability to set targets and management of schedules. On the other hand, these factors reflect project consultants' evaluation to designers' performance.

### CONCLUSIONS

The objective of gathering mutual feedback in construction is to learn from past experiences and to transfer this information to knowledge in the future projects. Its purpose is also to enhance communication and cooperation between parties. By identifying dissatisfaction factors, different parties can develop their processes, which benefit the whole project and indirectly to projects' intended users.

Interestingly, according to data analysis the designer's performance has evaluated poorer level than the other parties' performance. This might occur due to the fact that designers have to deal more entiresities and the final end product, in contrast to contractors and project consultants, which have to think and work with more details and day-to-day problems in the site. Typically, contractors have some unexpected or current problem, where they need information. In this case, the design process doesn't serve the construction production in the best way and designers' current ability of problem solving and quick response is weak.

On the whole, sophisticated feedback system and increased project communication can develop the cost management and control of the infrastructure projects for the better performance.

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# NEGOTIATING ACCESS INTO FIRMS: OBSTACLES AND STRATEGIES

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*Researchers often experience difficulties with the negotiation of access into firms for the purpose of data collection. The question we explore is: What are the main obstacles associated with access negotiation into firms; and what strategies do researchers employ to increase their chances of success? Our research work on the tendering process of contractors took place between 2006 and 2008. We successfully negotiated access into four firms (two each in Ghana and the UK) to observe live examples of tender preparation. The techniques we employed in negotiating access were personal contacts, contacting firms through online details and professional institutions, etc. With all of this effort, our average success rate was less than 5 per cent. The main obstacles encountered were firms' reluctance because of commercial sensitiveness and fear that the data could eventually be divulged to their competitors or end up in the public domain. However, some firms agreed mainly because of the written assurances of confidentiality and anonymity in reporting the study; reputation of the researchers' academic institution; gatekeepers who spoke to their colleagues on our behalf; academic purpose of the study; and a feedback report which was promised in return for access to the case studies. Although the access through personal contacts is by far the easiest, it is not always possible. Researchers can approach firms as complete strangers, especially in a foreign country, and that could make the firms more likely to assist the research.*

KEYWORDS: access negotiation, data collection, Ghana, observation, UK

## INTRODUCTION

Researchers often experience difficulties with the negotiation of access into organisations for the purpose of data collection (as explained by Buchanan et al. in Bryman 1988). This is particularly common when the data required is sensitive in nature (Koosimile, 2002). Between 2006 and 2008, we successfully negotiated access into four firms (two each in Ghana and the UK) to observe live examples of tender preparation. The aim here is to discuss our access negotiation experiences. We explore the obstacles associated with access negotiation into firms; and the strategies used by researchers, here and elsewhere in the literature, to increase the chances of success.

## LITERATURE REVIEW

A review of the literature revealed seven main points in relation to access negotiation obstacles and strategies. First, there are multiple layers of access negotiation into firms. Second, gatekeepers can be both advantageous and disadvantageous (Clark, 2010). Third, more than one technique often needs to be used to negotiate access. Fourth, a significant amount of sensitivity and skills is required in access negotiation. Fifth, personal contacts are useful but it is not always possible. Sixth, the main strategies for negotiating access in most cases are gatekeepers, making a good first contact, personal contacts, highlighting benefits to participants, and physical follow-ups. Seventh, the main obstacles to negotiating access into firms are layers of gatekeepers to overcome, ethics,

confidentiality, informed consent, lack of personal contacts, micropolitics in organisations, suspicion and bureaucratic formalities.

## NEGOTIATING ACCESS INTO FOUR FIRMS

The four firms involved in the study are hereafter referred to as Alpha, Beta, Gamma and Delta. Alpha and Beta are construction firms in Ghana. Gamma and Delta are construction firms in the UK.

The research interest here was the bidding process of contractors, which involves commercially sensitive information including prices and competitors. Past studies of contractors in the UK, for example Skitmore and Wilcock (1994: 142) had showed that gaining access to commercially sensitive information of contractors is difficult. Therefore, one access negotiation strategy was to use personal contacts and gatekeepers.

A number of our industry contacts provided assistance with our access negotiations. One of them suggested that the lead researcher should mention the fact that he was carrying out the research work as a foreigner in the country of study. According to him "...this will make the recipients more likely to assist your research". We found the advice to be in contrast with suggestions in the literature, which stated that the use of personal contacts would make firms more willing to assist the research. Ultimately, two of the case study firms were firms where we had no personal contacts at all.



The contractors who agreed to our access request mainly did so because of the influential role of the gatekeepers who spoke to their colleagues on our behalf; the academic purpose of the study; the written assurances of confidentiality and anonymity in reporting the study; and a feedback report which was promised in return for access to the case studies. It was also mentioned in the letter that the researcher's professional background as a Quantity Surveyor could enable him to provide an extra pair of hands to the bid team for some routine tasks.

It was difficult to secure access into the four firms. A wide range of ideas and skills had to be used. Each contractor was clearly concerned about the commercially sensitive nature of the data involved. The access gained into Alpha (Ghana) was achieved with the help of personal contacts in the firm. The access gained into Beta (Ghana) was also achieved with the help of personal contacts in the firm. In both cases, the contacts held high positions in the firms. The access gained into Gamma (UK) was achieved without the help of personal contacts. The contact detail of the gatekeeper was provided to us by the Civil Engineering Contractors Association. The access gained into Delta (UK) was also achieved without personal contacts. Lists of contact details found on the website of firms were approached. Out of 87 firms contacted only one of them responded by providing a case study opportunity.

## DISCUSSION

Five points are discussed. First, the main factor that facilitated access negotiation in Alpha and Beta was the use of personal contacts. Personal contacts facilitated the access negotiation process greatly which confirms assertions in Matthiesen and Richter (2007) and Winkler (1987). Second, time taken to negotiate access was longer in the case of Gamma and Delta. Third, access negotiation success rate varied in the four cases. The main concern for most contractors was not intrusion (as suggested in Gill and Johnson, 2010) but commercial sensitiveness of the information involved (as suggested in Skitmore and Wilcock, 1994). Fourth, one of the incentives to Gamma and Delta was the feedback report that was promised in return for the access to case studies. Fifth, the frustration encountered in the access negotiation processes is not unique to this study. Similar situations of frustration have been encountered by other researchers offer suggestions for dealing with frustration and fatigue issues in research.

## CONCLUSIONS

The question explored was: What are the main obstacles associated with access negotiation into firms; and what strategies do researchers, here and elsewhere in the literature, employ to increase the

chances of success? We successfully negotiated access into four firms between 2006 and 2008 to observe live examples of tender preparation. The techniques we employed in negotiating access were personal contacts, contacting firms through online details and professional institutions, etc. With all of this effort, our success rate was less than 5 per cent. The main obstacles encountered were firms' reluctance because of commercial sensitiveness and fear that the data could eventually be divulged to their competitors or end up in the public domain. Although the access through personal contacts is by far the easiest, it is not always possible. Contrary to assertions in the literature, researchers can approach firms as complete strangers, especially in a foreign country, and that could make the firms more likely to assist the research.

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# SATISFACTION WITH COLLABORATION: AN COMPARISON OF THREE CONSTRUCTION DELIVERY METHODS

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*Collaborative relationships in construction projects are influenced by the choice of the delivery method, because it determines the requirements, expectations, and preconditions for the project organization's collaborative working. The aim of this research was to explore the differences in the levels of satisfaction with collaboration in three alternative delivery methods in Finland; traditional Design-Bid-Build (D-B-B), Construction Management (CM), and Design-Build (D&B). The data consist of over 1600 evaluation entries in a Finnish project feedback system (ProPal), which is used for bidirectional feedback between the participants of a construction project organization, i.e. the owner, construction consultant, contractors, and designers. The level of satisfaction with collaboration is found generally higher in D&B and CM projects than in D-B-B projects. Four findings are addressed: 1) the owners' satisfaction with consultants and contractors is lowest in D-B-B, 2) the consultants' are more satisfied with contractors in D&B than in D-B-B, 3) the designers' satisfaction with consultants and contractors is lowest in D-B-B, and 4) the contractors' satisfaction for consultants is highest in CM. The conclusions recommend advancing the use of ProPal as a cost-efficient data collection method and addressing the collaboration between designers and other participants as a developing topic.*

KEYWORDS: collaboration, delivery method, organization, performance

## INTRODUCTION

The construction delivery methods differ in terms of the participants' roles and the sequencing of design, procurement, and construction works. The traditional Design-Bid-Build (D-B-B) delivery is customarily associated with an adversarial culture between the participants, whereas one of the goals of more modern delivery methods, such as Construction Management (CM) and Design-Build (D&B) is to improve collaborative working between the owner and other parties (Egan, 1998; Morledge et al., 2006).

Previous studies (e.g. Hale et al., 2009) provide comparisons of delivery methods based on time and cost performance. Yet, the future of a company's competitive position is not only based on the financial performance of the project but on the customer relationships, societal effects, process and product performance, and staff satisfaction. A large share of project success is dependent on the collaborative working in the multi-organizational team during a project (Leung et al., 2004). Thus, non-financial factors, such as participant satisfaction (Chan & Chan, 2004), are growing in importance. Collaborative working should, hence, be acknowledged as a crucial performance factor, and the choice of delivery method as one of the

prerequisites for construction project delivery organization's collaborative working performance.

This research aims to acknowledge the voice of all focal participants in the project delivery organization; the owner, consultant, designer(s), and the main contractor. Thereby the traditional scope of one-dimensional feedback surveys is exceeded and the successes and shortcomings of cross-organizational satisfaction to collaborative relationships can be compared in a multifaceted and revealing way. Three delivery methods, i.e. D-B-B, D&B, and CM, are included in the study to explore how they perform as the bases for collaborative working.

## Method, data and sample

Data for this study consists of ca 1600 entries in a Finnish project feedback system, ProPal, in which project owners evaluate the participants of the delivery team and participants evaluate one another's operations during a project. The evaluated topics are connected to a 5-point scale. The data was arranged by feedback flow (giver-receiver) and by delivery method.

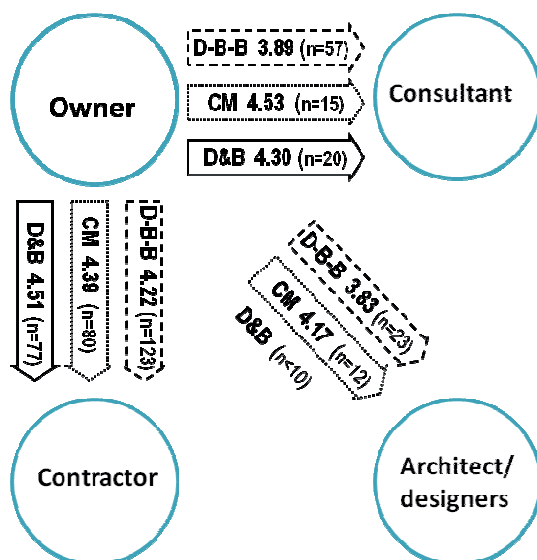
The analysis describes the general levels of satisfaction and outlines the major differences between delivery methods. A simple statistical test

was conducted with the T-Test Excel tool to support analysis.

### Collaboration satisfaction in D-B-B, D&B and CM

The overall satisfaction to the collaboration between the participants is on a good to excellent level (between 3.71 and 4.76 on a 1-5 scale). Notably, the satisfaction to collaboration in D-B-B tends to get the lowest evaluations within nearly all relationships. As all differences cannot be determined statistically significant, four conclusions remain. First, the owners' satisfaction with consultants and contractors is on lowest level in D-B-B projects (see Fig. 1). Second, the consultants' are more satisfied with contractors in D&B than in D-B-B projects. Third, the designers' satisfaction with the collaborative relationship with both consultants and contractors is on lowest level in D-B-B projects. Fourth, the contractors are most satisfied with their collaborative relationship with the consultants in CM projects. Another important remark was made stating that despite the delivery method, the worst satisfaction levels were found within the participants' relationships with the designers. The other parties consistently evaluate collaboration with the consultants on the best level in CM projects and, similarly, the contractors in D&B projects.

Figure 1: An excerpt of the levels of satisfaction in the bidirectional evaluation in three different delivery methods (here only one-dimensional owner evaluations for the participants). The figures refer to the mean value of the evaluations given in each category.



### DISCUSSION AND CONCLUSIONS

The results only partly confirm the traditional concern on the poor quality of collaborative working in D-B-B projects. D-B-B projects do, in fact, fall behind in comparison with D&B and CM projects in most relationships' collaborative performance but the overall satisfaction is higher than expected.

D-B-B is still the traditional and most common delivery method in Finland. The results suggest that the owners should be more open for the choice of D&B or CM delivery method when they are suitable for the project scope and goals, especially when the project would benefit from improved collaboration.

Another belief is refuted because collaboration with the contractors is not evaluated as difficult as industry reports (e.g. Egan, 1998) lead to suppose. Conversely, more attention should be directed to the collaborative relationships with the designers as those seem to be the ones causing most dissatisfaction. The owners' collaboration with consultants in D-B-B projects is another potential development area.

Experiences from the research process supports advancing the use of ProPal tool (and its prospective international counter parts) as a cost-effective data collection method that enables quickly analyzing the whole industry performance or selected parts of it.

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# INDUSTRIALIZED HOUSE BUILDING IN SWEDEN: A STRESS TEST APPROACH FOR UNDERSTANDING SUCCESS AND FAILURE

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*During the last 50 years industrialized house building in Sweden has had two faces. The first is a series of failed large scale projects that tried to introduce a more industrialized approach to the building of multi-family houses. The second face consists of a number of manufacturers of single family houses that for more than 50 years continuously has produced what in Sweden is called "catalogue houses". Based on information about one firm in each category the aim of the paper is to explain these successes and failures using a "stress test" approach focusing on how the different systems can handle stress in the form of changes in the business cycle, changes in tastes, technological problems and problems with suppliers. The main conclusion is that the failed systems for industrialized multi-family housing were not designed in such a way that it could handle different types of stress.*

KEYWORDS: house building, industrialized construction, flexibility

## INTRODUCTION

Industrialized building of residential houses - which here means off-site production of large elements - has been a controversial area at least since the Second World War. The history of industrialized production of residential housing is full of ups and downs. During the last 50 years industrialized house building in Sweden has had two faces. The first is a series of failed large scale projects that tried to introduce a more industrialized approach to the building of multi-family houses. The second face consists of a number of manufacturers of single family houses that for more than 50 years continuously has produced what in Sweden is called "catalogue houses".

This article compares two recent failed projects for industrialized production of multifamily houses (NCC-Komplett and Open House) with a successful producer of such "catalogue houses", called Company A.

## MAIN RESULTS

The paper argues that the following differences can explain these failures and successes.

### The structure of demand

Company A sells their houses to single households over a large part of Sweden. They have - compared to the size of the company - a large sales staff with direct contact with potential customers. As each household can be expected to have somewhat different preferences and also be affected by the business cycle and various kinds of trends in different ways, this reduces the risk of sudden large falls in sales. The sales staff in company A also has a strong incentive to quickly identify changes in preferences as they have a commission based pay.

Both NCC Komplett and Open House were producing multi-family housing and this means a smaller number of projects with a rather large number of apartments per project. Therefore there is a rather small number of potential buyers and this makes it very difficult to predict demand and very difficult to reduce fluctuations in demand. A complicating factor is that a considerable number of possible customers were municipal housing companies that according to the procurement act must use competitive tendering. They are not allowed to choose a specific company just because they like their products.

### The technology leap

Even though company A is less than 20 years old, most of the management staff and the production structure have a much longer history in the business. When they develop new models and open up for more choices for the customers they always make sure that they can produce them with the existing technology and the existing human capital. There are no great leaps in technology but only small steps to improve the product and the production methods. The risk from a production perspective is very low. NCC Komplett (and partly Open House) developed completely new complex products and - at least in the case of NCC-Komplett - a new production method compared to usual way of building multi-family houses. Both NCC Komplett and Open House underestimated the problems with implementing such a big change in the production methods.

### Inability to handle stress

A successful way of producing must be flexible enough to handle various unpredictable changes and events. The article argues that there were

important such differences between the compared projects/companies with respect to.

market and a risky technology probably would lead to losses also in the future.

1. *The business cycle*: One important difference described above is that the demand for company A's products can be expected to fluctuate less than for the two failed companies. It is also the case that when demand and production falls in company A, the loss in revenue will directly be spread over a large number of actors: The salespersons will get lower commissions, the independent contractors working with transport and assembling the houses will get less work and all of the suppliers will of course get less orders. Both NCC Komplet and Open House had a relatively larger share of staff employed themselves with a fixed monthly pay and did more inhouse.

2. *Shifts in tastes*: The close contact with the market, and the possibility to make rather large adaptations in the product when a potential customer wanted this, reduced the "preference risk" for company A. The strong incentives, especially for the sales staff, are important in this context. Even if NCC-Komplet and Open House also had a flexible product, still the structure was more fixed and the possibility to make quick adjustments was smaller due to the production technology.

3. *Technical quality problems*: Company A started with an established type of product and was very careful in their innovations to make sure that it could be produced with the existing technology. Both NCC Komplet and Open House used much more innovative techniques, and they were therefore also more risky.

## CONCLUSIONS

Perhaps the conclusion should also in this area be that revolutions are very difficult. The likelihood of failure is high when a company introduce a radically new way of producing. More interesting developments in the direction of industrialized house building are then to experiment with smaller steps, where e.g. somewhat larger components are bought from subcontractors. A more industrialized production process on site is then also more interesting than dreaming of large quick changes in what is produced off-site and what is produced on-site.

Some Swedish experts have argued that NCC closed down too early – they should have continued because after a few years the mistakes would have been fixed and costs would have fallen. The question is however if this would have happened so quickly as to make the net present value of continuing positive. Our belief is that the management made the right decision because the combination of high fixed costs, an unpredictable



# USEFRAME – A FRAMEWORK TO UNDERSTAND AND MAP USABILITY RESEARCH

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*Research concerning usability of facilities has its starting point in a need to understand the interaction between facilities and use and the characteristics of this interaction. Simply put; how buildings support the activities carried out in them by the users. This issue is also relevant to the construction sector as a whole as the focus on quality, value, end-users requirements and client needs is increasing. As “use” is a general term encompassing several aspects and perspectives there is a need for a framework to map and describe what has been in focus in different studies in order to define and relate different research approaches to each other.*

**KEYWORDS:** Facilities Management, use evaluation, Project Management, end-users, construction clients

## THE REBUS PROJECT

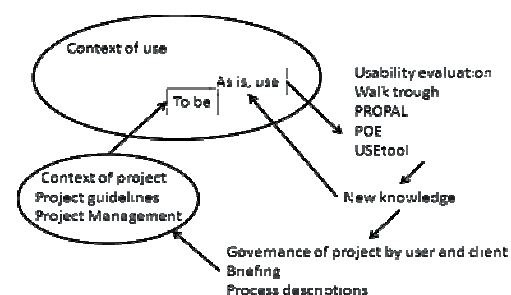
This paper reports on a development of a framework emerging out of a research project focussing usability. In the REBUS project, User-oriented Benchmarking for Usability and Sustainable Performance of Real Estate, a need for a framework to map, describe, understand and discuss aspects of usability was identified. Discussions led to a development of a framework that enable positioning of research related to studies of usability of facilities. It is an input to further development of research in the field of facilities management, usability and management of client requirements. It can also serve as a useful tool for focusing and communicating research within the area of usability and contribute to a structured FM-discourse on processes, organizational development, usability of places and construction projects. (Blakstad, Lindahl & Nenonen 2010)

If construction industry professionals can better understand the requirements of the users and translate them into the design and construction processes the results should be more efficient facilities. It is, however, not only about new methods and better processes, it is also about the actors in the processes and what governs their actions. Improvement depends on how professionals benchmark and how they manage usability related issues.

The REBUS-project took its starting point in an approach that starts in the use of facilities and not in the construction process that deliver the

facilities. The facilities in use are created through the interaction between organizational, business and spatial development processes. Several models and frameworks were discussed in order to grasp the different approaches in the national studies and to define and relate the different projects to each other. There was also a perceived need to relate what had been done in previous research to establish some state of the art understanding of how the concept of usability and uses were defined and utilized. As a result of discussions in the REBUS-project a framework was developed called *USEframe*.

Figure 1: The USEframe framework



## Useframe steps

Organizations have facilities that they *use* to support their activities in order to achieve the goals set for that organization. The facilities are used on a daily basis and during this use issues arise continuously among staff and maintenance staff

concerning the effects of the facilities. These experiences are fed forward to development of *new knowledge*.

Some issues that arise from daily use are of simple character and can be fed directly into action; changing the use or changing the facilities. Some experiences are also never or seldom collected until a process to act requires them, for example a redesign of a facility may require that staff is interviewed, e.g. as a starting point for a refurbishment project.

Development of knowledge can be augmented and supported by methods like walk-troughs, study visits, participation etc. or through evaluation approaches such as Post Occupancy Evaluation, POE (Preiser & Visser 2005). But also conceptual briefing methods can be used in this phase (Blyth & Worthington 2010).

The new knowledge that is created can be fed directly back to the daily activities or it can be evaluated and developed and fed forward to e.g. briefs, policies, guidance, or directives. The new knowledge must be articulated, or explicit, to be fed forward, otherwise it may only be carried in the actions of the people concerned. This process is where knowledge develops through an interactive and iterative process from tacit to explicit. (Nonaka and Takeuchi 1995)

The new knowledge that has been fed forward forms the basis for *governance and management of actions*. Often this concerns knowledge about the importance of the relationship between space and organizational performance (Becker & Steele 1995). This step concerns the development of principles that shall control or guide action.

When we know what to do, as documented in briefs, guidelines etc, and when we have guidance on how to do it; via project management policies, and knowledge of with which resources and which responsibilities that apply; then we can act. The action, *the project*, is managed in a context; organizational, cultural, political etc. (Fenker 2008) The action is directed to support, affect or change the future use of, in the REBUS-project, facilities for organizations. Once the experiences from *use* have been transformed and fed forward via the *project* to the new use *to be*, the new or changed facilities will be completed.

## CONCLUSIONS

The REBUS-project led to a development of a framework that enable positioning of research related to studies of usability of facilities and subsequently to a possibility to map where a research project has its focus. The framework is

presented as an input to further development of research in the field of usability. It concerns use of facilities, usability and management of client requirements. The model aims to be a basis for development of a structured FM-discourse on processes, organizational development, usability of places and construction projects.

The framework can of course also be used as a basis to discuss the process from *as is* to *to be* and when doing that methods and approaches can be put in a framework context and discussed. The framework does not illustrate an ideal process or *the* process, however, it is believed that it in its basic form actually does grasp all the important steps in a process concerning understanding of the user and user context.

Another issue, related to the above, that is important to study further, is the short cut, often used in construction, from *as is* to project within *context of project*. This enables efficient projects but raises questions of how to get data and client requirements from the *knowledge development* process into the *context of action*.

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# PROJECT MANAGEMENT - WISE AFTER THE EVENT

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*Construction project management theory, to the extent that it exists, draws on ideas taken from mainstream project management theory and its fundamental assumption that universal solutions are applicable to projects that are more or less the same. A common explanation when things go wrong, and source of debate, is the perceived uniqueness of the industry. In this paper we investigate if we can learn anything from looking more closely at the practices in an industry that by and large is even more unique than construction. We ask ourselves what mystic processes make the event industry deliver under high pressure to firm deadlines and what can we learn from one sector to another. Are there dubious structures or is the delivery done in joyful partnering? The paper draws on individual experiences from event industry. Conclusions are drawn highlighting areas in which research towards understanding performance mechanisms in projects can fruitfully be undertaken.*

**KEYWORDS:** project management, event management, uncertainty, project organisation

## PROJECT MANAGEMENT

Projects and project organising have been given a great deal of attention in the literature over the past decades, and numerous are the articles that seek to further our understanding of project management and the management of projects. At present, influential project management thinking tends to assume that all projects are fundamentally similar and the universal approaches to project management as prescribed by leading institutes for practitioners, such as APM and PMI, are self-evidently justified. Neat and tidy assumptions allow for a set of guiding principles that by and large have served to be very useful in practice.

Construction is in many ways the epitome of a project-based industry and project-based organisational forms have long been the norm in the sector. Decentralisation and dispersed modes of working are especially important defining characteristics (cf. Leiringer et al., 2009). The industry's leading firms have tended to adopt a decentralised structure to enable different divisions to compete in different market sectors. These different divisions in turn work on projects that are temporary, often one-off and rarely undertaken within a standard framework. The construction project management literature frequently struggles to bridge on the one hand, that construction is heralded as unique, and on the other hand the temptation to be influenced by ideas taken from production and project management, both of which share tendencies to prescribe universal and repeatable solutions.

### Key issues

In this paper we ask ourselves, what can we learn from a sector that by all intents and purposes is

even more 'unique' than construction? Our point of departure is the view of construction as 'production by projects' and the call for additional theoretical insights needed to understand construction production processes. To start we present an industry where organising through projects is the norm and where projects is the only basis for social structure, power and finance, i.e. the event sector. It is argued that traditional management theories fall short in explaining or predicting the behaviour on most event projects. Vignettes are presented of different aspects of event projects, each highlighting how individual determinants of power are all important in understanding how projects are managed successfully. Particular attention is given to the governance structures that ensure that people perform although they are very loosely coupled to the temporary organisation of the project. The discussion focuses on the high degree of temporality of the projects and how networks of suppliers are mobilised in which most of the staff work project by project.

## EVENT MANAGEMENT

Construction projects are commonly carried out by temporary organisations populated by individuals belonging to a variety of permanent organisations or firms. These firms are either commissioned by others to contribute to the realisation of external projects, or they carry out internal projects which are financed and commissioned by themselves. The former is the most common and the majority of the construction work force is employed by firms to work on one or a few projects at a time.

An event project, on the other hand, is not only made up by suppliers in networks, for many of the suppliers their working life is network-based and

they do not belong to a permanent organisation. When there is a project there is a job, when there is no project there is no job. Not only is the event industry organised in projects – the whole business lives its life through projects. Most suppliers and specialists are self employed. Specialists, e.g. a set designer or choreographer, get their next job based on their individual network and performance. The progression from project to project is based on an intricate mix of power based on who you know and what you have done; the old cliché about ‘your latest performance’ certainly rings true. Or simply put by a production manager: “You’re no better than your last job”.

‘Culture, communications, stakeholder’ involvement and planning’ are key features along with a strong focus on people. The capability to meet deadlines is put forward as a key characteristic of the event industry; interestingly completion on budget is not Hartman et al. (1998). Other features include, that there are multiple owners, unclear boundaries, a squeezed project life cycle and no structured reporting and governing pattern. All of these aspects put up challenges and generate continuous changes to the participants. A key challenge is the transformation of the organisation from planning to execution mode as the organisation changes structure and has a significant increase of staff and volunteers in the run-up to the event Löwendahl (1995). In “one-off” temporary organisations like event organisations staff also tend to stay on for the complete run of projects. Not as in many project based industries where competence or contract decide whether you are in the project or not.

The project culture in events is comfortable with risk and uncertainty, and it is characterised by extreme task uncertainty. Most staff undertakes activities they have not done before, to a large degree assisted by volunteers and with very little opportunity to translate previous experiences directly into the project.

## DISCUSSION

The two main issues addressed in this paper concern how event projects are organised and how the actual managing of the projects is carried out. Organising takes place in an uncertain environment. Personnel are functionally divided and most perform basic assignments, often without clear work descriptions. This is achieved through a hierarchical and complex structure where networks of suppliers, such as freelancing production staff, event technology companies, staff hire firms, flower shops, caterers etc. make their specific delivery. All involved perform their tasks on the basis that it will determine their next job. Even if the event is a team effort on the surface it is rooted

in the individual’s drive to stay in the network, i.e. to get into the next project. The intangible output and objective of many event projects require a flexible organisation governed by definite goals. The result is an organisation that accepts hierarchical structures, acknowledges delimitations of assignments and where roles and power are more important than organisational boxes.

## Actual management

Motivation is a key ingredient in managing paid personnel as well as volunteers. Leadership requires balancing between comradeship and authority. This kind of leadership has to be based on strict plans to allow for quick decision making, as well as a capacity to deviate from plans in order for the event to go ahead. This puts strain on the relationship between team and leader, a relationship that in order to be efficient needs that both parties are aware of the specific conditions of the event industry and the importance of achieving the deadline. The concept of delivery by deadline is fundamental for understanding the industry. So too is the lack of formal governance. Most staff are not formally employed by firms and employed based on trust, for example email communication, rather than through a formal contract. The staff, is hired on the basis of perceived competence and is expected to deliver, if not there is no next job. This type of situation is different from the one we see in construction that usually is framed by detailed drawings and specifications and contracts defining the delivery.

## CONCLUSION

Studying the event industry provides us with a number of relevant questions to ask when debating organising and project management in construction. The project management toolbox that already exists can certainly be further developed. Especially in terms of dealing with uncertainty, time constraints and complex organisational structures, all of which the event industry excels at.

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# PERFORMANCE MEASUREMENT SYSTEM FOR BENCHMARKING IN CONSTRUCTION COMPANIES

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*The Brazilian real estate sector experiences a period of strong growth, greatly encouraged by the abundance of financing, capitalization of construction companies on stock exchanges, extension in the stated periods for payment, flexible credit and investment in public housing. In this context, performance measurement through indicators is one of the main contributions that can be implemented to support the necessary modernization of the construction industry, also helping to detect opportunities for improvement through comparing performance (benchmarking). The purpose of this paper is to discuss the development of a performance measurement system for benchmarking in construction companies, whose standard methodology of data collecting and processing allowed the comparison of performance and the generation of benchmarks for the sector. The research methodology included accomplishing the following stages: making a diagnosis in order to identify the performance measurement systems adopted by construction companies, setting a standard system of indicators, deployment of the standard indicators in 13 (thirteen) selected construction companies in the city of Recife/PE and collecting results. The obtained results helped establish a standard for undertaking benchmarking, define reference values, and also identify a set of differences in some of the adopted indicators and a collaborative environment among the companies involved.*

**KEYWORDS:** performance measurement, indicators, benchmarking, construction.

## INTRODUCTION

Brazilian civil construction is undergoing a time of strong growth. After a period of uncertainties caused by the 2008 international economic crash, the sector seems to resume growth, boosted by prospects of new public investments in housing and increased property credit by the banking institutions. The production chain of civil construction today is one of the most robust sectors of the country's economy.

This is the scenario where construction companies today are finding increasingly tough competition, in conjunction with the vital obligation to meet the stakeholders' requirements. Consequently, many construction companies have given more importance to developing and implementing performance measuring systems.

Performance measuring is a process in which the decision is what to measure and from there collect, process and assess data. As stated in Lantelme et al. (2001), measurements must be grouped to form a cohesive and balanced system, helping to control key processes and detect possible improvement by comparing results (benchmarking).

Comparing performances between companies with a view to establish benchmarking has been much more frequent in the civil construction sector. A series of benchmarking projects have been developed in different countries in the world

(Bakenset al., 2005; Constructing Excellence, 2010), namely Brazil, Chile, Denmark, Holland, Portugal, UK and USA.

## OBJECTIVE

The objective of this article is to present the development of a performance indicator system for civil construction companies, whose standard data collection and processing methodology enabled the benchmarking practice and generation of reference values for the sector.

## METHODOLOGY

This study was developed by adopting a methodology with four different stages (Diagnosis; Structuring the standard performance indicator system; Implementing the system; Analysing implementation and results)

## PRESENTATION AND ANALYSIS OF THE DEVELOPMENT OF THE INDICATOR SYSTEM

In the first stage of the research (diagnosis), aspects relating to data collection and processing, analysis and dissemination of the indicator results were identified. The provided macro-flows of processes were analysed and made it possible to identify ten main processes that are part of the Quality Management System (QMS), as follows: commercial, human resources, planning, design, supplies, administrative, financial, works, technical assistance and training.



The results relating to the objectives, indicators and targets were organised by processes in order to summarise the information collected. Overall, 173 indicators were identified, with special mention to the 62 indicators in the job process and 38 indicators in the commercial process - the processes with most indicators.

In the second stage (structuring the standard performance indicator system), thirteen construction companies in Recife that operate in the commercial and residential construction participated in the project, and formed a group of companies with similar characteristics, except with regard to size, since the group had small, midsize and large companies.

Eight processes and the prime objectives relating to them were selected next. The set of indicators was selected at six fortnightly working meetings, coordinated by the authors of this article and attended by representatives of the companies. In the end, 20 performance indicators were defined.

Cards with all information necessary for collection, processing and analysis of the selected indicators were created for their suitable characterisation. The cards contain information, for example, about the process in which the indicator is entered, the indicator's purpose, the collection periodicity and the calculation guide.

In the next stage (Implementing the system), a dynamic site (online platform) was designed to collect and process the indicator results. From the platform it is possible to enter the indicator results, creating at the end of each period, individual reports for the companies' inquiries and also general reports to help compare performance.

Individual and general reports are issued after validating all data entered through the online platform. The individual report consists of details of all values entered by the firm during that month, while the general report contains mean and average information, and maximum and minimum values, past benchmarking and number of entries (sample) so that the companies can compare their performance with the others.

In the last stage of this research (Analysis of implementation and results), it was found that in general the companies tried to enter the proposed system in that which already existed in the QMS.

In relation to the information transferred during the implementation stage, some companies successfully absorbed and disseminated it, while others failed, encountering a problem during the collection period. Consequently, failures in

collection were found, leading to results not in keeping with the proposed methodology; these results had to be excluded during the validation process.

Indicator collection began in August 2010, with three collection cycles, creating a volume of around 600 results already entered. At this time, none of the participating companies managed to collect the 20 proposed indicators, stressing that some of them depend on work stages not yet reached. Moreover, there are indicators with six-monthly and yearly collection periodicity.

At the end of the third cycle of data collection, a survey was conducted aiming at a general assessment of the indicator system developed and first results. It was possible identifying aspects of all different stages of the project.

The companies listed some of the main benefits gained from the implementation of the system, being the main of them the comparison of results of the company with the others (benchmarking practice). Turning to the main difficulties found, it is possible mentioning the difficulty in spreading the measurement practical between the involved and responsible for the processes.

## CONCLUSIONS

The developed indicator system benchmarking, based on adopting a standard data collection and processing methodology, was designed for benchmarking and generating reference values for the sector.

The results show that the system meets the measuring requirements of construction companies, which were able from the project to find a favourable environment for data analysis and systematisation so that they were able to compare their performance with the other companies. All of these companies have shown interest in continuing with the standard data collection system through the online platform to encourage them to develop their practices by benchmarking.

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# DESIGN COORDINATION PROCESS IN CONSTRUCTION COMPANIES: REALITY AND IMPROVEMENTS

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*The last ten years have seen many changes in the Brazilian civil construction industry with heavy investment in the sector and tough competition. Many construction companies, helped by the formalization of their processes with the ISO 9001 certification, adopted design coordination policies with a view to anticipating decisions regarding the definitions of the characteristics of the product and production. This paper provides suggestions for improved design coordination process in construction companies, consolidated by undertaking literature review and case studies in four construction companies in the city of Recife/Brazil. The results have shown that the companies formalized the design coordination process based on certification; there is a growing concern on how best to coordinate designs, with registration and analysis of the information from coordination meetings and compatibilising designs and the increases in design use for production and design assessment tools. However, there is also high improvement potential, especially arising from the informality at some stages, such as the initial feasibility study of the projects and the need to develop designs before starting the job.*

**KEYWORDS:** design; coordination; building construction.

## INTRODUCTION

Many construction companies, helped by formalizing their processes with ISO 9001 certification, have adopted design coordination policies in order to take decisions on definitions of the product's characteristics and production systems. However, the results of the frantic pace of real estate launches are that there are fewer designers available and it is essential to increase productivity and effectiveness of the design coordination process.

## OBJECTIVE

This paper presents suggestions for improved design coordination process of construction companies, and which are consolidated by literature review and case studies in 4 construction companies in the city of Recife/Brazil.

## BUILDING DESIGN COORDINATION

Design coordination can be defined as an activity that provides support for developing designs, whose prime objective is to guarantee that they consider the overall objectives of the project, increasing the quality and constructability (Franco & Agopyan, 1993). It is understood that design coordination seeks to synergically integrate the requirements, knowledge and techniques of all those involved in this stage, requiring from the design coordinator expertise in the necessary flow of information at this stage, authority to take decisions and settle disputes on behalf of the

entrepreneur (AGESC, 2006). Melhado (2005) and Ceotto (2008) emphasises the need for coordination throughout the design process, which must encourage interactivity between the members of the design team to thereby improve the quality.

## CASE STUDY RESEARCH

### Metodology

Stage 1 – literature review and questionnaire preparation based also on the the authors' experience, it was subdivided into three parts: characterization of the construction company, characterization of the design coordination process, and a check list containing best design coordination practices. Stage 2 – interviewing proper. Field investigation by applying the questionnaire in building construction companies to check the existence in 4 construction companies in the city of Recife. Stage 3 – analysis of the results and providing suggestions for improved design coordination process.

### Results Findings

The four construction companies in the case study research and their design coordinators are identified by letters A, B, C and D. The purpose was to identify the organisation of the design coordination process of each company in the study, taking as reference the questionnaire.

During the investigation with the companies, a question about the direct participation of other

sectors in the design coordination process was asked. Companies B, C and D informed that the engineering team on the project actively participates in the coordination activities, which indicates the concern not only with the aesthetic and functional nature of the designs but also with the rational execution of the work.

Also based on NBR ISO 9001, the companies were asked if there were indicators in the design process and which were they. Companies A, C and D had indicators, as Table 1 illustrates.

Table 1 – Design Indicators

Company	Indicators			
A	Number of design revisions	-	-	-
B	Degree of compactness	Wet/dry are ratio	Average thickness of concrete structure	Number of intakes per m <sup>2</sup>
C	Degree of compactness	Slenderness ratio	Percentage of front windows	-

In relation to planning to adopt new indicators in company A, it may be considered that among the three companies that have indicators, the average is four indicators per construction company, which shows that these companies are concerned with developing instruments that produce information for new projects, as support for the design coordination process.

At this stage of data collection, a list was made of some best practices of design coordination and the questions asked whether they are used in the companies under study. Interviews were personally conducted with the companies project managers in order to collect information listed in the check list.

From these items, it was analyzed the degree of care to them, noting that 65% of respondents met the best practices presented, especially in the development phase of the project. The phase with a lower rate of positive responses was product production.

The items described in the check list that obtained 100% compliance by the companies were: undertaking designer assessment; designers' knowledge on which criteria they will be assessed; participation of production engineers in the design concept stage; preparing designs for production and use of post-occupation assessments in adapting future designs. The items that had fewer positive answers were also listed, with at least two companies that answered the question, in the lowest to highest number of companies that considered it: design closure and assessment meeting; the designers being informed of the

results of post-occupation surveys; assessment of the designs by the production team; start of the job after completing all designs; use of information technology tools to help coordinate designs; existence of a formal scope containing specifications of the design delivered to the designer. The main suggestions for improved design coordination are listed below.

## SUGGESTIONS FOR IMPROVED DESIGN COORDINATION PROCESS

The paper provides suggestions for improved design coordination process into: design coordination choice, design quality plan, design coordination meetings, design management system, design planning and programming, design and designer assessment, indicator of the design coordination process and design versus job execution integration.

## CONCLUSIONS

Within the design development process, it was found how important and necessary were the efforts to improve design coordination, principally by adopting follow-up tools and assessment of the quality of goods and services produced by the process. Interviewing the construction companies showed that the design coordination process was based on the ISO 9001 certification and also that there was high potential for improvement. The best practices study showed the 35% potential for taking actions that consider improving the design coordination process. Lastly, it is considered that the set of suggestions proposed in this study could be adopted gradually, planned in steps, one step will encourage taking the next.

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# SCOPE ANALYSIS OF THE DESIGN AND SERVICE PROCESSES FOR PRODUCING VERTICAL NON-LOADBEARING MASONRY

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*The design for producing non-loadbearing masonry offers high potential for improving the design process in building construction. However, one of the problems worth mentioning is the lack of accurate definition of the range of its scope, causing doubts about what, when and how it should be prepared, developed and delivered by the designers. The main purpose of this paper is to investigate and analyse the application of the scopes of the designs and services of vertical non-loadbearing masonry in building construction using case studies in the cities of Recife in Pernambuco State and the city of São Paulo in Brazil. The results obtained have shown that achieving the reference scope adopted – the Brazilian Association of Design Managers and Coordinators (AGESC) handbook – averaged 61% (builders) and 57% (designers), while the concordance with the scope averaged 45% (builders) and 56% (designers). Lastly, it gives guidelines on scope of how to use the AGESC handbook on design and services of vertical non-loadbearing masonry, describing potential uses and stressing the contributions to greater integration between expectations and resulting products, to more rationally facilitate the design and execution of non-loadbearing masonry in building construction.*

**KEYWORDS:** design; non-loadbearing masonry; scope; building construction.

## INTRODUCTION

The use of the design to produce vertical non-loadbearing masonry (DPVM) has been recommended as a mechanism of high potential for improving the design process in Brazilian building construction.

However, many problems still exist with regard to its development and use (Aquino & Melhado, 2005; Corrêa & Andery, 2006; Maneschi & Melhado, 2010); design incompatibilities due to lack of integration among designers, executive difficulties the work team's resistance, lack of design coordination to the absence of considerations on the performance of non-loadbearing masonry and, mainly, lack of precise definition of the range of scope of services involved in preparing the design for production.

The Brazilian Association of Design Managers and Coordinators (AGESC) (2008) prepare standards as a benchmark for design contracts, one of which concerns the handbook on scope of design and services of non-loadbearing masonry (2008).

The main purpose of this paper is to present the results of a case study survey relating to the investigation and analysis of the application of the scopes of design and services of vertical non-loadbearing masonry.

The methodology of this survey consisted of the following steps. Step 01 – review of literature of

DPVM in the design and scope process of DPVM. Step 02 – two questionnaires were formatted: 1st) characterisation of the construction companies, the design coordination, the project, the design process, the premises of DPVM and DPVM scope; 2nd) characterisation of the designer companies, the designer, the design process, the DPVM process, the premises of DPVM and DPVM scope. Step 03 – undertaking a field investigation for applying the questionnaire in 02 real estate construction companies and 02 designers DPVM in the cities of São Paulo and Recife. Step 04 – analysis of the results and drawing up guidelines for applying the DPVM scope. The survey lasted six-months.

## RESULTS

The 04 construction Co. and their projects are identified by A, B, C and D. The information was provided by the design coordinators of the construction companies and the designers DPVM. Some results are presented in sequence.

### Attention and concordance to the AGESC handbook on DPVM scope

Table 1 show the results relating to attention and concordance to the AGESC handbook on DPVM scope in function of the project. The results correspond to the sum of weighting the averages of positive attention at each stage in the design process. The weights used when weighting were attributed to the quantity of essential services at each stage in the design process in relation to total essential services at all these stages.



Table 1 – Attention (x) and concordance (y) to the AGESC handbook on DPVM scope per project

Projects	Construction Co.		DPVM designers	
	(x)	(y)	(x)	(y)
A	69%	46%	67%	60%
B	77%	38%	67%	60%
C	58%	37%	43%	54%
D	41%	59%	49%	49%
Average	61%	45%	57%	56%

Considering the attention (x) in Table 1 to the handbook on scope from the construction company's viewpoint is greater than for the DPVM designers, although with just a slight difference. Probably the designers are more critical when adopting the handbook because of their greater knowledge of the established activities relating to each service. Considering the concordance (y) regarding the scope handbook in the opinion of the DPVM designers is greater than that of the construction companies, with a slightly higher difference of 10%. Probably the fact that the DPVM designers have more knowledge of the handbook contributes to the result, even more so considering that the majority participated in the concept of the handbook in question. The highest percentage of concordance is attributed to project D (construction companies) and projects A and B (designers), while the lowest concordance is attributed to projects C (construction companies) and D (designers). Note the differences between the construction Co. and the designer of project D.

#### Guideline for application of AGESC handbook DPVM

The AGESC handbook DPVM (2008) is unequivocally the top and most comprehensive national reference on this subject and it is necessary to progress in the application. The following comments are intended as a guide on how to use/apply the AGESC handbook DPVM.

a) It can be used more than once in the design process: when forming the design team, still at the stage of hiring the designers, it can be used as a reference to define DPVM activities and services, establishing the operating coverage, objectives and responsibilities. The handbook lists the activities/services that can still be undertaken. It can be used to point defects regarding the DPVM content when analysing designer's proposals.

b) Help in developing the design plan: it can help the design coordinator and design team to determine and hierarchise the activities considered for developing the design plan, to standardise the

terminology used, design team communication and to establish control points in the timetable.

c) Definition of the DPVM scope: the AGESC handbook consisting of 61 services (essential, specific and optional) that form six stages in the design process. This group defines the general structure of scope of DPVM, it can also be a target of a specific checklist consisting of all the necessary elements for checking the scope, measuring progress, assessing the risks of non-compliance and redirecting efforts to integrate this set of absent activities.

d) Control of the changes in the DPVM scope: checking attention to the scope is a way to assure the contracting party that the DPVM considers the set of elements. When there is some change in scope, it is easier to identify the activities/services that were not initially defined and the effort required to develop them.

#### CONCLUSIONS

The case study survey focused on checking compliance in projects and harmonisation of the aforementioned handbook with the opinions of the construction companies and DPVM designers. With regard to compliance and concordance with the benchmark adopted – the AGESC handbook on DPVM scope (2008) – the results obtained demonstrated a wider difference was found between compliance and concordance among the construction companies compared to the DPVM designers. It is believed that the guidelines proposed for application of the handbook on scope of DPVM will contribute to further integration with the products desired by the stakeholders, facilitating a more streamlined development of the actual design and providing the service.

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# STRATEGY WORK IN A LARGE CONSTRUCTION COMPANY: PERSONIFIED STRATEGIES AS DRIVERS FOR CHANGE

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*Strategizing can be seen as a balancing act between aggregating knowledge and experiences from an organization's past business cycles and forecasting future possibilities over a longer period of time. Yet knowledge about strategizing over business cycles and in rapidly changing market conditions in the construction sector is scarce. This paper takes a micro perspective on strategizing and examines individual narratives of change processes to identify driving factors. The empirical data is part of an ongoing longitudinal case study in a large construction company on strategizing over business cycles from 1990 until today. The study comprises in-depth interviews with 14 key actors and a wide range of documentation covering the period. The Strategy-as-Practice perspective serves well as a retrospective description of strategizing over time; understanding the dynamics that underlie the various strategic changes is a matter of understanding what the strategists have done. The paper shows that strategy processes mainly are related to a few individuals (mostly the CEO's), rather than to the activities or rationale behind them. This paper contributes a novel perspective on the strategy literature in construction by emphasizing personified strategies as drivers for change. We argue that personified strategies are an intra-organizational phenomenon related to power distribution, governance, and the tensions between individual agency and the institutionalized context.*

**KEYWORDS:** diachronic perspective, strategy as practice, personified strategies

## INTRODUCTION

Corporate strategies are context-dependent and forward-looking conceptions, formulated by a given configuration of actors, at a specific time, under particular socio-economic conditions. As such strategizing can be seen as a balancing act between aggregating knowledge and experiences from an organization's past business cycles and forecasting future possibilities over a longer period of time. A company's strategizing impacts its efficiency, innovativeness, competence development, customer focus, environmental sustainability and its work processes. Yet knowledge about strategizing over business cycles and in rapidly changing market conditions in the construction sector seems to be scarce.

The construction industry is an important player in the Swedish economy and on the labour market. However, it has been criticized for low productivity, lack of innovation, negative environmental impact and its large percentage of errors and waste (Lutz & Gabrielsson, 2002). These problems may in part come from the industry's difficulty to leverage knowledge and to develop and foster its unique competencies, which in turn may be explained by a lack of integration of human-resource and knowledge management at the strategic level (Björnström, 2007). There seems to be a lack of awareness among strategists of the interdependencies between strategizing and its operational implications over business cycles. This is probably related to a strong tendency to focus on

functional strategies, resulting in efforts being concentrated to a single, short-term objective such as project costs. However, the world in which we live is changing rapidly, driven by globalization, internationalization and technological advances. To maintain an edge in a changing market, construction companies must continuously cultivate and develop their competences and intellectual capital. The need for improvements has induced new subjects on the agendas: including for example the pursuit of a more efficient building process, increased safety for the workers, ethical code of conducts, and sustainable development. Such initiatives force management in construction to administer their organization based on more standardized ways of work and this is often accompanied by a more centralized organizational structure (e.g., Zábojník, 2002). All these issues pose challenges for practitioners as well as researchers. To propose viable models and solutions, researchers "need to get close to the sense-making of key organizational actors and appreciate the world from their point of view" (Johnson et al., 2008). Over the last decade Strategy-as-Practice has grown as a distinctive field of strategy- management study (e.g. Whittington 2006; Jarzabkowski et al 2007). Strategy-as-Practice focuses on strategizing as situated, social practice constructed through interactions of multiple actors embedded in institutional contexts. The foundation of Strategy-as-Practice is to highlight the micro-actions by which human actors, the strategists, create strategic outcomes; strategy is not something that an organization has, it is

something that the “strategists” do. (Whittington, 2004; Jarzabkowski et al., 2007; Jarzabkowski et al., 2008; Gerry Johnson et al., 2007; Whittington, 2007). This paper takes a micro perspective on strategizing by examining individual narratives of change processes, draws on a Strategy-as-Practice perspective to support the argument that strategy processes are often associated with individuals (mostly the CEO’s), rather than with the activities or rationale behind them. This paper contributes a novel perspective on the strategy literature in construction: it shows how many of the major changes implemented in the studied construction company can be viewed as personified strategies.

## THE CASE

Alpha is one of the largest domestic contractors within building and civil construction as well as services related to road construction and civil engineering. The empirical data is part of an ongoing longitudinal case study at Alpha, on strategizing over business cycles from 1990 to date. In-depth interviews with 14 upper-level managers were carried out during 2010; 11 out of the 14 interviewed managers had been working at Alpha for 15 years or more. This part of the study has applied an explorative and interpretative approach.

## CONCLUSIONS

We identified an interesting phenomenon when examining the managers’ narratives. Epochs, personal experiences, strategy processes, and decisions were all dimensions in which a salient individual focus emerged. All these dimensions were personified to a large extent, the interviewees seldom referred to the rationale behind the time epochs, the personal experiences, the strategy processes, and the decisions, but rather to the specific CEO that they associated the events with; that person embodied the events to the point of representing the event itself. The Strategy-as-Practice perspective advocates an emphasis on what people do, but it would probably have appeared as reasonable for many researchers and practitioners, to understand Alpha’s transformation throughout the years as the strategies that Alpha (as a company) had and the strategies that Alpha (as a company) changed – in relation to e.g. their market, their competitors, their internal resources. Such units of analysis, however, risk ignoring the inter-subjectivity dimensions of what the strategists do; and overestimate the degree of causality between e.g. market, competitors, internal resources and specific company actions. The story told in this article supports this point as well as the most fundamental standpoint of the Strategy-as-Practice perspective – “strategy isn’t something an organization has, it is something that the strategists do”, and from the perspective of a number of

upper-level managers in our study, it is something that some few individuals did (mainly the CEOs).

It is clear that Alpha throughout time has reacted to circumstances, e.g. by changing their strategies – but via the subjectivities of these persons (the strategists). Some of the strategic actions presented in the case are however examples of when the strategists’ subjectivities probably align closely with the institutionalized context. But even these more “obvious” strategic changes were personified in the narratives; processes and decisions are formalized, but they are also personified. The upper-managers included in this study related changes throughout time to the different CEO’s; and it seems like every CEO is associated with major changes. Noel (1989) concludes that it was the CEO’s unique personalities that decided the strategic direction for a number of companies that were studied in a field research setting, and the stories told in this article indicate something similar – strategic change is perceived as something that the CEO’s have done, rather than as a process or as a rationale. Burgelman et al. (2005) note that internal corporate development cycles usually span over a longer period of time than a CEO usually stays at the same company; important long-term development strategies might therefore be disrupted if every CEO wants to (or feel they have to) change the strategy. Regardless of the effects from development cycles; personified strategies could likely diminish the holistic effects of strategizing; as the sum of a company’s competencies all together – which is the rationale behind the more standardized organization that Alpha has transformed into, in order to meet the challenges on the changing markets.

The notion of “strategist” remains unproblematic in the Strategy-as-Practice field. This article is a first attempt to bridge this gap. Concentrating on upper-level managers, we have seen that there seems to be a tendency to associate strategic change with one specific strategist (the CEO). Such a perception could result in norms that put all responsibilities and risks onto one person. Furthermore, such pressure may be one reason why new CEOs may feel obliged to institute change (of any kind). However, associating strategies and changes with one person may also exaggerate the role of one strategists, understating the roles of others who may be equally involved in strategising; if upper-level managers associate change mainly with one top-level strategist, what responsibilities do they ascribe to themselves? If strategic change is actually driven by one strategist’s subjectivity; then we could ask ourselves whether we can refer to strategy as a concept at all.

# INFLUENCES OF CONSUMER-CONSTRUCTOR RELATIONSHIPS IN THE GREEN-BUILDING MARKET

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*Green building market is rapidly expanding around the globe as the concept of green building and sustainable construction are becoming increasingly recognized by stakeholders in construction industry. In response to consumers' concerns on sustainability issues, the construction industry has to adjust their attitudes and perception towards planning and utilizing of the built environments. Having perceived that interactions and relationships between consumers and constructors play an important role in exerting efforts to promote and attain the prospective achievement of green building market, this paper introduces a conceptualized framework for examining influences of the consumers-constructors relationships (CCR) by using qualitative research methods. It is expected that findings in this study will facilitate conceptualizing improvement of interactive CCR among construction stakeholders so that they can eventually attain mutual benefits from green building markets.*

**KEYWORDS:** Consumer-Constructor Relationships, Green Building Market, Relationship Marketing, Sustainable Business Development

## INTRODUCTION

Green building has recently become an integral part of sustainable development strategies. However, development of green building markets still faces many challenges due to its high costs of design and construction. Green building initiatives are yet to be fully investigated and accepted by construction stakeholders. As consumers' choices can influence constructors in introducing sustainable construction practices, this paper aims to conceptualize a framework for investigating influences of consumer-constructor relationships (CCR) on green building market (GBM). A preliminary structural model for CCR assessment is also developed.

## LITERATURE REVIEWS

### Sustainable Construction & Green Building

'Sustainable construction' addresses the ecological, social, and economic issues of a building such as to reduce resource consumption, reuse and recycle resources while 'green building' focuses on character and quality of the structure built by using sustainable construction's principles and methods.

### Green building markets (GBM) and consumer-constructor relationships (CCR)

In response to the global sustainability concerns, construction industry has introduced the concept of green building to expand its market as well as to retain its competitiveness and possibility of future business expansion. Consumers' environmental concerns are then translated into market demand.

### Green building relationship marketing

Right marketing and communication are essentially required for green building enterprises. Strong

relationship outcomes depend on both successful relationship marketing tactics and consumer personality. Problems of CCR can be distinguished into economic and socio-psychological approaches, of which marketing are simultaneously needed.

## OBJECTIVES AND METHODOLOGY

Main objectives of this paper are to:

- 1) provide preliminary overviews of the CCR's theoretical influences on GBM's operations.
- 2) preliminarily conceptualize a framework for assessing influences of CCR within the context of GBM development and retention.
- 3) create a preliminary structural model for conducting a further empirical study of CCR's influences on GBM's success.

## Theoretical Framework

Based studied literatures, theoretical constructs of CCR's influence on GBM are presented in Table 1.

Table 1: Theoretical Constructs and Factors.

Major Constructs	Influencing Factors
Green Building Objectives	Economic interests
	Environmental concerns
	Social perspectives
	Technology Innovation
Consumer-Constructor Relationships	Impression/Appreciation
	Satisfaction
	Trust
Performance and Success of GBM	Commitment
	Consumer Acceptance
	Voluntary Participation
	Long-term Retention

## Methodological Framework

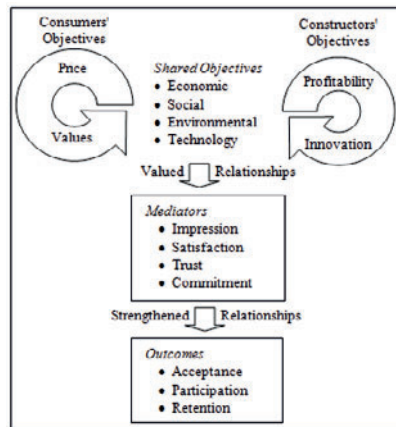
The theoretical framework is developed using the qualitative analysis approach. Then the associated variables of influencing factors are to be further identified. Field data will be collected by means of questionnaire surveys and then quantitatively analyzed through the developed structural model by means of structural equation modelling (SEM) analysis technique. The revised final model should enable this study to verify the model applicability.

## RESULTS: A PRELIMINARY INITIATIVES

### Conceptualized Framework

The conceptualized framework for assessment of CCR influences in GBM is shown in Figure 1.

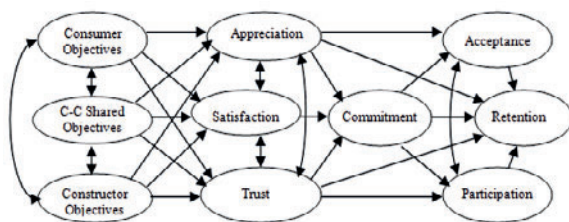
Figure 1: A Framework for Assessing the Influence of CCR in Green Building Markets.



### A Preliminary Structural Model

As a start for SEM analysis process, a preliminary structural model for assessing influences of CCR in GBM is developed, as shown in Figure 2.

Figure 2: A Starting Structural Model for CCR Influence Assessment.



## CONCLUSIONS

Success of green building business could largely depends on management of relationships between constructors and consumers. Together with a preliminary study of CCR influences in GBM, a conceptualized framework and a starting structural model used for assessing such influences are developed and presented in this paper, providing a fundamental step for further in-depth research.

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# THE USE OF SUPPLY CHAIN MANAGEMENT TO REDUCE DELAYS: MALAYSIAN PUBLIC SECTOR CONSTRUCTION PROJECTS

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*Construction delays are a critical problem for Malaysian public sector projects. These delays have been blamed mainly on inefficient traditional construction practices that continue to dominate the current industry. This paper reports the progress to date of a Ph.D. research project aimed at developing a framework to utilize Supply Chain Management (SCM) tools to improve the time performance of Malaysian Government projects. The potential of SCM has been identified for public sector governance and its use in Malaysia is now being considered within the strategy of the Malaysian Construction Industry Master Plan (2006-2015). Encouraged by success in the UK, there is a cautious optimism concerning the successful application of SCM in Malaysia. This paper considers delay as a problem in Malaysian public sector projects, establishes the need to embrace SCM and then elucidates the need and strategies for the development of a delay reduction framework. A literature review, survey mechanism and structured interview schedule will be undertaken to achieve the research objectives. The final research outcome will be a framework that addresses root delay contributors ("pathogens") and applies SCM tools for their mitigation.*

**KEYWORDS:** Supply Chain Management, construction projects, construction delay, public sector, Malaysia.

## INTRODUCTION

In a developing country such as Malaysia, the public depend heavily on the government to properly deliver services and infrastructure and play the lead role in the industry's growth. In Malaysia, the construction sector is critical for the country's job creation (i.e. creates 800,000 jobs) and wealth creation as it directly contributes to the wellbeing of other industries such as manufacturing, professional services and education (CIMP, 2007). However, highly fragmented, adversarial relationships, lack of trust, low quality, low productivity, poor customer focus etc., have been common criticisms of the construction industry since the Industrial Revolution. Project delay has been a critical problem for the industry especially concerning public sector jobs. The domination of traditional practice has been mainly blamed for these weaknesses and has greatly affected the industry. The research described in this paper tries to address this issue by suggesting SCM as the way forward for improving construction project's time performance.

### **Malaysian Public Sector Projects: Delays and the Need to Change Practices**

A particular problem in Malaysia is project delays. These have been a continual problem for construction industries worldwide, particularly in developing nations such as South East Asia, African nations and many Asian countries. In

Malaysia, delays in construction projects have been a recurring problem and are well known to be worse in public sector projects. The time overrun rate of public projects has been so high (i.e. at 80% in the year 2009) as to make it a common topic of concern for researchers, practitioners and the local public alike.

As a result, and in light of the low contribution of this sector to the country's GDP, several attempts have been made to improve the situation. One such attempt has been the industry's initiative to involve the private sector in government developments (i.e. BOT, BOOT, PFI, etc.) since 1983. However, the time performance of construction projects still poor, indicating that a transformation in the way projects are performed and managed is necessary. Calls for improvement and reform have also been made by many countries, including Australia, Sweden, Finland, Hong Kong, Norway, Singapore and the United Kingdom (Love et al., 2004), but again with little improvement in results.

In the research community on the other hand, construction delays have been largely addressed by identifying the contributing factors involved. This has resulted in a variety of lists detailing up to hundreds of delay causes, grouping them into distinctive categories, examining different procurement practices, studying numerous project types etc. However, in the case of Malaysia,



research in relation to this topic has been limited – particularly from the public sector’s perspective.

One recurring result of previous research has been that the various participants in construction projects (i.e. client, contractor and consultant) seem to blame each other for the faults causing delay (Al-Kharashi & Skitmore, 2009). This paper argues that for an inter-related environment such as construction, in which the success of a project requires input from all parties, a ‘blame-game’ mentality is counter-productive. The construction industry is now so dynamic and complicated which, when combined with higher competition levels, makes it hard for organisations to be self-sufficient. Organizations therefore need to work together, pool resources, share knowledge and skills and compete with each other in order to maintain their competitive edge.

### **The Way Forward: SCM**

A common tenet of construction management is that better integration would solve the problems of construction industry. Supply Chain Management (SCM) offers a means of doing this. SCM is a concept originating from manufacturing which stands strong on the notion that better integration increases performance, reduces fragmentation, improves organizational relationships, improves trust, encourages continuous improvement etc. In recent times, research into SCM has gained the interest of researchers in the area of construction management trying to solve certain aspects of the industry in order to make it waste free, allow better communication and coordination, improve quality, productivity and service excellence and so on.

However, in order for SCM to be implemented properly, it should be developed in a holistic manner (i.e. use SCM to mitigate all aspects of delay contributors), but as yet little attention has been paid to this area. There are many tools promoted through SCM that eliminate non-value added activities from the system, increase trust, improve inter-organisational and intra-organizational coordination and promote continuous improvement, not only to the industry, but also to each involved supply chain. These tools could also be based on a number of theories such as Transaction Cost theory, Contingency theory, Social Exchange theory etc. which explains how an organisation could relate with their partners to create a mutually benefitting partnership. The research described in this paper therefore aims to develop a framework which would present the tools related to the SCM concept which would be useful to reduce delay in Malaysian public sector projects.

### **The Research Route**

For a more simple, manageable and effective framework, the research will first identify the latent conditions, or ‘pathogens’, leading to delay problems. The pathogens are those faulty activities that remain hidden in the system until an associated problem arises (Busby & Hughes, 2004). These, it is argued, need to be identified in order to solve the problems created and prevent subsequent chain reactions. This involves obtaining the point of view of all the main supply chains in a project (client, contractor, supplier, local authorities, consultants, etc.). Later, a number of SCM tools will be fitted to deal with each of the pathogens. A combination of quantitative and qualitative data collection approaches will be used to develop and validate the framework to suit Malaysian public sector governance of projects.

### **CONCLUSIONS**

Project delay has been a dilemma for Malaysian Public Sector projects. Previous studies suggest utilization of SCM could prove beneficial for the industry’s advancement (Egan, 1998; Love et al., 2004). The infancy of SCM in Malaysia pose a challenge for the research, however, there is a good prospect for introducing SCM into the nation’s construction practices. The outcomes of the research also aim to fill a gap in empirical studies in relation to SCM. Backed with the proven success of SCM with a few UK clients, the research is expected to greatly benefit the Malaysian public sector in achieving better time performance in its projects. In addition, it is expected that the framework could, with some modifications, also benefit other nations seeking similar initiatives.

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# THE DESIRE FOR THE CONSTRUCTION INDUSTRY TO MOVE TOWARDS LIFECYCLE CARBON EMISSIONS ANALYSIS

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*A significant reduction in carbon emissions is a global mission and the construction industry has an indispensable role to play as it is a major carbon dioxide (CO<sub>2</sub>) generator. Over the years, various building environmental assessment (BEA) models have been developed to promote environmentally responsible design and construction. However, limited attention has been placed on assessing and benchmarking the carbon emitted throughout the lifecycle of building facilities. In this paper, current BEA approaches adopted by the construction industry are first introduced. The focus of these models and concepts is then examined. Following a brief review of lifecycle analysis, the boundary in which a lifecycle carbon emission analysis should be set for a construction project is identified. The paper concludes by highlighting the potential barriers of applying lifecycle carbon emissions analysis in the construction industry. It is proposed that lifecycle carbon emission analysis can be integrated with existing BEA models to provide a more comprehensive and accurate evaluation on the cradle-to-grave environmental performance of a construction facility.*

**KEYWORDS:** Carbon dioxide, emission, building environmental assessment, buildings lifecycle

## INTRODUCTION

The increased atmospheric concentration of carbon dioxide (CO<sub>2</sub>) has become a very critical and urgent problem, having been shown to exacerbate many environmental hazards. As a major industry in most countries, the construction sector emits significant amounts of carbon directly and indirectly from various activities.

To encourage the design and construction of more environmentally responsible buildings, various building environmental assessment (BEA) concepts have been developed. However, current BEA approaches evaluate general environmental performance of a building, rather than focusing on carbon emissions. There is a lack of systematic approaches to audit and benchmark the lifecycle CO<sub>2</sub> emissions generated by a construction facility.

This paper summarises the current development of BEA tools, followed by a discussion on the relation between the cradle-to-cradle concept and carbon auditing. The paper concludes by examining the challenges of analysing lifecycle carbon emissions in the construction industry.

## DRAWBACKS OF BUILDING ENVIRONMENTAL ASSESSMENT

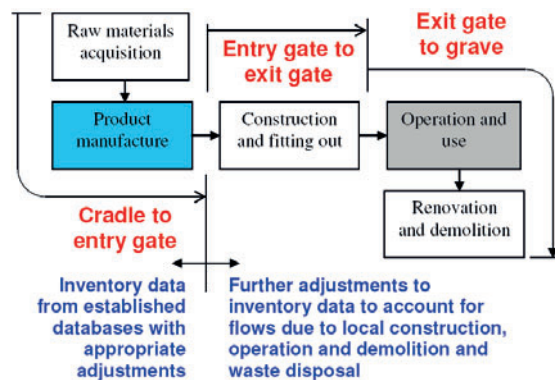
Despite the success of BEA tools to date, some weaknesses have been identified (Ding, 2008):

- The assessment process is usually carried out when the project design is almost finalised, limiting the use of BEA methods as design guidelines.
- Since BEA methods are used to evaluate building designs, they are less useful for selecting optimum projects where different options or locations of development are considered at the feasibility stage.
- Some assessment tools such as BREEAM, BEPAC, LEED and HK-BEAM has limited emphasis on the financial aspects in the evaluation framework. The project may be environmentally responsible but offer insufficient financial returns to the developers.
- Most BEA methods were developed for local use and do not allow for national or regional variations. While the BEA tool has been developed for regional use, there are still some limitations, namely: when evaluating buildings, the weights are scored subjectively; the complexity of the BEA framework makes it difficult to use; the BEA has led to a very large and complex system, causing difficulties and frustration for over-stretched assessors rather than producing a global assessment method as intended (Curwell et al., 1999).
- BEA methods have overly comprehensive criteria.
- Current BEA methods cannot measure and evaluate qualitative environmental issues.

## APPLYING LIFECYCLE ANALYSIS IN CONSTRUCTION PROJECTS

In the construction industry, not much attention has been directed to evaluating the lifecycle CO<sub>2</sub> emission of a construction facility. Therefore, it is necessary to carefully consider and evaluate the lifecycle emission of construction facilities, viz. the extraction and processing of raw material, production processing, distribution, operation and waste management, etc. The carbon emissions for a construction facility should be presented as the tonne of carbon dioxide equivalent (tCO<sub>2</sub>e) generated by each metre square of the floor space or per dollar spent on the construction at least from the cradle to grave perspective (Figure 1).

Figure 1: A cradle-to-grave concept for assessing the carbon emissions in the construction industry.



This can be realised by first delineating the emissions generated during the manufacturing and transportation processes up to the point of the entry gate of a construction site. While further processing would be necessary on site, the energy consumed during the construction process until the facility is built (i.e. to the exit gate) should be carefully accounted for. More importantly, one should not undermine the energy usage during the operational stage and that used for disposing the materials at the end of the facility's life.

In general, the implementation challenges of the lifecycle carbon emissions analysis comprise four groups (Proveniers et al., 2009):

- Conceptual challenges – including inexperience with the lifecycle carbon emissions analysis concept, lack of lifecycle carbon emissions reduction design and building materials, as well as associated risks.
- Economical challenges – due to the traditional way of thinking focusing only on initial investment, not being willing to pay more, and pre-judgement of the expense involved.
- Actor challenges – the many people involved in a lifecycle carbon emissions analysis process can cause internal and external conflicts of

interest among parties. The complex relationships between industrial activities and different stakeholders make it difficult to implement lifecycle carbon emissions analysis strategies.

- Measurement challenges – recent material and energy accounting methods are not broad enough to provide sufficiently comprehensive data (Liu, 2009).

## CONCLUSIONS

While many studies have confirmed that a construction facility produces a significant amount of CO<sub>2</sub> throughout its lifecycle, a radical rethink of how to improve the current building environmental assessment approaches to incorporate the lifecycle carbon emissions is imperative. Apart from the operational phase, with the highest contributor to CO<sub>2</sub> emissions, any emissions generated during the planning and design phase, material manufacturing phase, construction process phase, maintenance and renovation phase, as well as deconstruction and disposal of waste material phase should be taken into consideration. By adopting a lifecycle carbon emissions analysis concept, the potential for reducing the dependence on raw materials, recognising the negative impacts caused by producing new materials, and intensifying the recycle and reuse process should increase across the construction industry.

## ACKNOWLEDGEMENTS

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# CIVIL ENGINEERING DRIVERS AND INDICATORS

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*Once a closed market, civil engineering is now genuinely opening up. In the past, forecasting the industry has consisted mainly of assessing the public sector's budget realisation, but now there is a gradual move towards a market-based model, introducing an opportunity to assess the construction market by means of market research. The opening and globalisation of the market also presents additional information needs and needs to indentify the pieces of information that best predict future development. The research question has been to define the future development of the civil engineering markets. The key indicators have been chosen for several reasons, the main reason being that despite the availability of some longitudinal data statistics remain, on the whole, inadequate. The used method on analysing the change is contextualism, in other words, studying long-term process in their context. In a closed market, activities are planned according to the available resources. In an open market, demand depends on the needs of customer industries and on financial considerations. The most important leading indicators for forecasting civil engineering construction are public sector budget, private sector outsize projects and GDP change.*

Keywords: key indicators, civil engineering, market change, forecast

## INTRODUCTION

Infrastructure construction has undergone a transition from a largely closed market to an open one resulted from EEA Agreement (1994). The migration of customer and production sectors to a market open both nationally and internationally has created discontinuities on many different levels. The significance of reliable business information has increased. Market information is needed both for short-term operational planning and for long-term strategic planning.

This paper explains the key indicators for civil engineering in three different time periods: before 1990 (closed market), 1991–2010 (revolution phase) and after 2010 (open market). Indicators have changed and will change because of structural changes in the civil engineering sector. The most important leading indicators before 1990 were the public sector's investment plans (state) and regional investments (municipalities). The time period 1991–2010 required two further indicators, namely outsize projects and owners', planners' and contractors' surveys. The new indicators brought a significant improvement to forecasting.

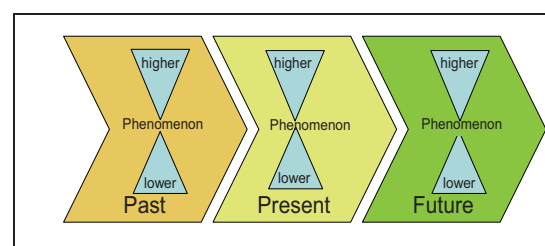
## RESEARCH QUESTION AND METHOD

The main research question has been to define new key indicators to help forecasting future civil engineering market development.

A contextual analysis of a process such as change draws on phenomena at vertical (time) and horizontal levels of analysis and the interconnections between those levels through time (Pettigrew, 1990). In this context the horizontal

higher level refers to political changes and lower level changes that take place inside civil engineering sector (See figure 1)

Figure 1: Analysis method is to study long-term processes in their context



## PAST AND PRESENT

### Time period before 1990, market structure

Civil engineering has always been closely tied to the development of society and business life. Civil engineering is needed when suburban areas and communities are constructed. In addition to specific needs, the civil engineering industry was used as a tool in labour and regional politics up until the 1980s.

The labour political dimension was discarded due to technological development and unemployment benefits, while the regional political dimension remained until the 1990s. The relevant and sufficient indicators were at that time public budgets and GDP forecasts.



### Time period 1991–2010, market structure

Since the recession at the beginning of the 1990s civil engineering has also been guided by economic realities. Projects are given priority according to how they boost the economy. Part of the public infrastructure has become privately owned; in this respect, decisions are made on a purely economic basis.

Since the mid 1990s many of the formerly closed markets of civil engineering construction have been opened up for international competition. Besides public budgets and GDP forecasts new tools like surveys were needed to forecast civil engineering market development. Also outsize projects were followed up.

### FUTURE

#### Period after 2010, market structure

The period after 2010 starts with an insecure financial situation and demonstrates the reverse side of globalisation. The world monetary crisis in 2008 and the subsequent rapid recovery keep the oil price high and have influence on the civil engineering sector. The European economic situation is also insecure because of the Greek and Irish economic difficulties.

#### The future forecasting indicators

*Private sector investment.* Investments in energy, district heating, water supply and airports are made by the private sector. These sectors, more or less dependent on the economic situation, decrease their investments very quickly if the economic situation gets worse, weighting GDP as an even more important indicator.

*RAKSU group expert opinion.* In Finland a group of experts meets four times a year to discuss civil engineering and the economic situation. The experts represent various sectors, such as contractors, scientists, ministries and construction sector associations. The group forecasts the civil engineering volume for the following year for publication on the web pages of the Ministry of Finance (Raksu, 2010).

*Surveys of actors.* VTT conducts biannual surveys among contractors and civil engineering investors (municipalities, state and private organisations).

Over recent years the survey of planning engineering offices has been reasonably successful in forecasting the changes in civil engineering. Contractors' surveys are another good indicator for future development, with knowledge months in advance of the forthcoming market situation based on the number of calls for bids.

*Outsize projects.* The state budget finances a number of large-scale projects, as do private companies.

Development work on the key indicators continues in 2011. A new research (Vainio & Nippala, 2010b) will possess a more scientific touch, including testing of the theory described in this paper.

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# THE LIMITATIONS OF TRADITIONAL APPROACHES TO WORK-LIFE BALANCE FOR SUPPORTING PROFESSIONAL AND MANAGERIAL STAFF

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*Significant difficulties exist in the application of 'work-life balance' in the construction industry due to challenges presented by the masculine nature of the industry, the project-based nature of the work and the travel involved. The paper aims to investigate the extent to which work-life balance initiatives operate within professional and managerial staff in construction related work. Qualitative in-depth interviews carried out with over 100 construction personnel in the UK reveal significant difficulties in maintaining a satisfactory work-life balance. The data shows that men have been neglected by existing initiatives which focus on women and caring arrangements. In addition, the employment context shows that while in many cases the self-employed work very long hours; they report greater levels of satisfaction and flexibility in managing their time commitments. The paper argues for more research including men also including the employment context to be carried out but also that a seismic shift within the construction industry needs to take place to include changing societal conditions.*

**KEYWORDS:** work-life balance, gender, professional workers, managers, qualitative research

## INTRODUCTION

Work-life balance is an important theme in the mainstream HRM literature but understanding of the concept is varied. Traditionally it has been considered a female-oriented term, used to refer to organisational initiatives that offer women the opportunity to balance their caring commitments with an opportunity to participate in the employment market. 'Work' has been considered as something that comes in the way of 'life' (i.e. caring responsibilities). More recently it has been recognised that work-life balance should be about *"the ability of individuals to pursue successfully their work and non-work lives, without undue pressures from one undermining the satisfactory experience of the other"* (Noon and Blyton, 2007: 356; emphasis added).

Our question is: do organisational work-life balance initiatives address the needs and wishes of both men and women? Effectively this provides a reverse order investigation into 'equality:' what about work-life balance in terms of men having the same opportunities and access to organisational support as women?

We will explore this research question with reference to a heavily male-dominated sector: the construction industry (focus of the conference). This inherent gender-imbalance allows us a deliberate advantage in questioning value-ladenness of the concept.

It is important to view work-life balance from the male perspective for two reasons. Firstly, the working population in the construction industry is heavily male dominated. Organisational work-life balance initiatives that only cater for the minority (women) in the sector are not achieving their full potential (Smithson and Stokoe, 2005: 149). Secondly, but related to the need to form efficient and effective organisational policy and practice, the question about supporting the work-life balance of men is pertinent as the notion of the 'new man' emerges (Hearn, 1999; Watts, 2009: 42).

The new man is arguably keen to spend time with the family and values personal wellbeing, where traditionally the male role has been that of a breadwinner with long working hours (Watts, 2009: 43). In the last decade, the popularity of the work-life balance agenda has strengthened academically (ibid: 2) but it has also gained government/ political support in the UK and the European Commission (Bryson and Karsten, 2009: 40). While much of the legislative developments have extended the rights of women, there are changes that seek to address the previously limited provisions for men, for example father's right to use up maternity leave (Stevens and Phillips, 2009).

## RESEARCH METHODOLOGY AND METHODS

The qualitative in-depth interview data was collected within an overall interpretive paradigm relating to people employed in the construction

industry. Altogether over 100 interviews were conducted in the UK with people employed in a variety of settings from sole practitioners to large organisations in the industry. All respondents held professional/ managerial roles in the participating organisations. The sample includes group level directors, middle managers (contract-, programme- and project managers) and junior/ operational site-based managerial staff (such as foremen) together with professionals such as architects, design co-ordinators, quantity surveyors and engineers. All interviews were tape recorded, transcribed verbatim and analysed using qualitative data analysis software (NVivo).

## FINDINGS AND CONCLUSION

The data reveals significant concerns over maintaining a satisfactory work-life balance. Interestingly, the traditionally gendered view is challenged by some men in the sample who voice strong need to operate locally in order to stay close to home and occasions where female respondents prioritise their career ambitions. With regards to employment context, the self-employed report working long hours, yet commend much greater levels of satisfaction with flexibility in managing their time commitments. Overall, informal approaches to managing work-life balance are most common; however, there is significant variation within and between organisations usually relating to management style.

Time management and flexibility emerged as the significant themes in terms of the challenges to achieving satisfactory work-life balance (for both men and women). An intriguing paradox is apparent here. On the one hand, there is a lack of understanding on the part of the employers about their employees' work-life balance and the respondents highlight significant concerns regarding this. At the same time, while the self-employed work equally long hours, their attitude is notably positive. This contrast between the salaried and self-employed respondents is fascinating - it is not as if there is a trade off between employment security and work-life balance with the salaried personnel as keeping up with the job is a key driver for working the long hours. Central to the dissatisfaction of those employed thus appears to feature a lack of control over their working lives. In terms of flexibility, variation between respondents between and within different companies was notable. However, it was also recognised that the flexibility was likely to be particularly applicable only in certain parts of the organisations; more linked to specific managers' style/ approach to managing their people, and therefore informal. All the sole practitioners as well as the local authority workers mentioned flexibility as an advantage.

To conclude, we found no difference in the preferences of men or women in their commitment to work and life but that organisations practice work-life balance 'bottom up' supporting employees informally. Our argument is thus threefold:

- (i) more gender-balanced research is required within male dominated industries if work-life balance policies are to achieve their full potential;
- (ii) where the existing debates have overlooked the employment context this is an important variable in establishing and maintaining work-life balance; and
- (iii) while a seismic shift in industry culture is required to address issues reported by our respondents, this will be difficult to achieve. Innovative solutions are required to negotiate the changing societal conditions and levels of commitment professional and managerial personnel exhibit towards their work.

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# FROM WORK PROFILES TO WORKER PROFILES

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*In developing new office environments and in improving the existing ones it is important to understand the end-user needs. In order to add understanding of the end-user needs a typology for profiling office workers is suggested in this article. Methodologically the research was carried out in two phases. In the first phase 21 interviews were conducted and a discourse analysis was carried out. The result of the discourse analysis was four orientations that the end-users applied in their talk about their working environment. These were named people orientation, territory orientation, object orientation, and system orientation. In the second phase, another set of interviews were carried out and a directed content analysis was used to analyze the data. One of the four orientations named above dominated 12 out of 14 interviews. This allows for the conclusion that it is possible to categorize individuals according how they speak of their working environment. The persons in different classifications had an internally coherent ways of constructing the reality of their workplace and a common way to rationalize existing spatial solutions.*

**KEYWORDS:** end-user profiling, workplace, content analysis, discourse analysis

## INTRODUCTION

In many offices the working environment consists of identical work stations even though there are differences in the ways of work among different persons. One solution has been to identify the work profiles of employees and develop workstations and usage policies suitable for different work profiles.

Still, even though individuals have the same work profile, they still may carry out their duties in different manner and they may see their working environments differently. Thus, this article suggests that it would be more beneficial to understand different kinds of individuals better when new office environments are developed or existing ones are improved.

This article suggests a typology that may be utilized in profiling different kinds of office workers in order to understand different sub-sets of end-users and their needs. This typology is tested empirically in the case study setting.

## METHODOLOGY AND FINDINGS

The study was carried out in two phases. In the first phase 21 interviews were conducted and a discourse analysis was carried out from them. The results of the discourse analysis revealed four orientations that the office workers used in their talk about their working environment. These were named object orientation, system orientation, people orientation, and territory orientation.

The discourse analysis revealed the orientations, but it does not tell if the orientations are present in all workplace related speech or if individuals may be classified by the way they talk. Hence, a second set of data was analyzed with a qualitative content analysis.

The content analysis reveals that 12 interviewees out of 14 did use one dominating orientation in their speech. Thus it was possible to classify interviewees' speech according to the object orientation, system orientation, territory orientation and people orientation. Persons in different classifications had an internally coherent ways of constructing the reality of their workplace and a common way to rationalize existing spatial solutions.

For example the persons using object orientation and territorial orientation talked mostly negatively about their environment. Typically the object orientated speech included statements about what is wrong in the working environment without providing rational reasons for these negative expressions. The territorially oriented speech rationalizes the problems in the working environment by comparisons. The reason for problems in the office may be found from the organizational hierarchy.

The persons with system orientation and people orientation perceive their working environment much more positively. They rationalize in positive

terms the problems that the object oriented person brings up. A system orientation includes justifications of many problems by understanding the working environment as a system, which may not work optimally. Thus rational argumentation and reasoning is satisfying the persons, who are system orientated.

The persons with people orientation reflect the work environment in a social context. If the working environment supports social relationships, it is functional. If it does not, the working environment is dysfunctional. The people oriented speech and system oriented speech included expressions which indicated that they may trade something bad if they gain something good in exchange.

## **CONCLUSIONS**

This article provides understanding of different types of office workers and introduces one way of understanding one important asset of every company – the employees. The analysis of the speech about the workplace can provide a new, interesting source of information both for workplace designers and for researchers.

The empirical material was limited to one case organization and the results cannot be generalized. However they provide a starting point for further investigations.

For further research it would be interesting to test the orientations more and to try to identify if the orientations are constant. The possibilities to develop more tools to link such typologies to the work style typologies would add possibilities for workplace designers and managers to match the suitable workplace solutions for variety of worker preferences identified through the individual construction of the workplace speech.

# REVALUING BENCHMARKING – A TOPICAL THEME FOR THE CONSTRUCTION INDUSTRY

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*Over the past decade, benchmarking has increasingly gained foothold in the construction industry. The predominant research, perceptions and uses of benchmarking are valued so strongly and uniformly, that what may seem valuable, is actually abstaining researchers and practitioners from studying and questioning the concept objectively. This paper addresses the underlying nature of benchmarking, and accounts for the importance of focusing attention on the sociological impacts benchmarking has in organizations. To understand these sociological impacts, benchmarking research needs to transcend the perception of benchmarking systems as secondary and derivative and instead studying benchmarking as constitutive of social relations and as irredeemably social phenomena. I have attempted to do so in this paper by treating benchmarking using a calculative practice perspective, and describing how this perspective develops more thorough knowledge about benchmarking and challenges the current dominating rationales. Hereby, it is argued that benchmarking is not a neutral practice. On the contrary it is highly influenced by organizational ambitions and strategies, with the potentials to transform organizational relations, behaviors and actions.*

KEYWORDS: benchmarking, construction, calculative practices, critical

## INTRODUCTION

We, as benchmarking researchers and practitioners, risk getting caught in a self-created captivity of rigid values if we do not constantly challenge and revalue the way we perceive and use benchmarking.

This paper challenges the dominating rationales and transcends the prevalent studies, discussions and theories that surround benchmarking by questioning the values and premises for the effectiveness of benchmarking. In order to do so, a calculative practice perspective is applied.

## THE VALUE RIGIDITY OF BENCHMARKING

World-wide change in construction is high on the agenda, and a comprehensive effort is made to improve quality and efficiency in the construction industry. As a result, benchmarking has gained foothold in construction and can be found in various designs, deployments and contexts.

A broad normative consensus surrounds the concept (Triantafillou, 2006). Fernie *et al* (2006) argue that measuring performance is important when exercising control, but falls short when seeking reliable explanations for; the link between practice and performance, trying to fully understand the organizational changes measurements generates and how best practices are diffused. The consequence of this is that the underlying nature of benchmarking – the mechanisms that make benchmarking work in organizations – get no or little attention. Knowledge about how benchmarking and adoption of best practices impacts organizational practices remains underexplored. Since the effectiveness of

benchmarking is reliant on its activation of organizational mechanisms when doing benchmarking and adopting best practices, it is paradoxical that these continues to remain underexplored.

This paper seeks to contribute to an alternative understanding of benchmarking, by applying a calculative practice perspective on benchmarking, in order to provide knowledge about how to study and understand the mechanisms that constitutes the effectiveness of benchmarking.

## CALCULATIVE PRACTICES – A WAY TO REVALUE BENCHMARKING

Much like benchmarking, accounting practices in organizations had for a long time been perceived as rational practices with objectively empirically verifiable descriptions of reality that provides managers an unambiguous space for necessary actions and decision making. But unlike benchmarking, this embedded interpretation of accounting practices has been revalued, and is today questioning the practices of quantifying reality into figures that can be analyzed and acted upon by managers as if they were pure evidences. One major argument is that accounting practices are not purely initiated to calculate cost or evaluate a particular investment opportunity but are instead always intrinsically linked to a particular strategic or programmatic ambition thus going beyond the task for which they are deployed (Boland & Pondy, 1983; Miller, 2001). Recognizing this left the roles and organizational impacts of accounting practices in organizations obvious objects of study - commonly referred to as *calculative practices* in the accounting literature. Calculative practices



break with the traditional perception of accounting practices as rational, secondary and derivative, and instead characterize them as intrinsic and constitutive of social relations and social phenomena (Miller, 2001).

Accounting practices should be studied as key resources to stimulate individuals and organizations ability to commit to desirable targets through reflective self-organization, hence enabling new ways of acting upon and influencing the actions of individuals, driving them to pursue the notion of “normality” created by the calculative practices (Miller, 2001). Accounting practices are perceived as ways to represent reality in a manner that provide decision makers a facade of objectivity and transparency.

### **What Calculative Practices can do for Benchmarking Research**

A calculative practice perspective rejects benchmarking as a neutral practice. Instead it shall be understood as constituted by its calculative practices and the way these influence behaviors, actions, perceptions and decision making processes in organizations. The object of research is not the benchmarking system but rather the calculative practices that emerge in organizations due to the system. Such a perspective will contribute to the current knowledge about benchmarking, by studying the underlying nature of benchmarking and creating a basis for questioning the premises for its effectiveness. By applying this critical perspective, calculative practices offers a way to underpin a research framework for critically studying; how benchmarking is ascribed meaning and acted upon in organizations, the relationship between measured performance and organizational practices, individual interpretations and managerial intensions etc. – all premises for the effectiveness of benchmarking. Understanding benchmarking from such a perspective is a requisite to meditating upon and challenging benchmarking to change in particular ways.

### **BENCHMARKING AS CALCULATIVE PRACTICES**

The calculative practices of benchmarking will reveal answers to how benchmarking systems change organizational processes in different organizational settings, and will dismiss the idea of measures and performance indicators as neutral representations of reality. By questioning the production of numbers as a rational practice, benchmarking is perceived as a process as a managerial strategy to intervene in established organizational settings.

Benchmarking forces individuals into ways of thinking and acting. Thus benchmarking is not

separated from the reality it seeks to provide information of. On the contrary, it is intrinsically linked to reality, since it shapes and creates reality. Benchmarking is making use of moderate liberalistic regulation and acts on individual's interests through external regulations. It creates a rationality that forces individuals to interpret and relate their actions to measures and to being measured, thus, invoking their awareness (and self-interest) in how to adjust in order to realize self-serving interest optimization. Calculative practices claim that it is this fostering of an action oriented organizational behavior that eventually end up changing organizational processes and achieving organizational improvement; Benchmarking acknowledges individuals freedom of action, but simultaneously makes them act appropriately by creating the social room for maneuvers. Benchmarking systems are models of rationality constructed to normalize performance that generally seen, standardize the organizational actions acting on the common interest of individuals – thus becoming appropriate methods for pursuing purposes.

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# INVOLVING USERS IN THE DEVELOPMENT OF EMBEDDED TECHNOLOGY IN CONSTRUCTION

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*Based on a project about user driven innovation and embedded technology in construction (BIIB), the paper discusses methodological issues on user involvement. In the paper especially focus is on the experiences on involving users in collaborative development of scenarios, in the validation of scenarios and in developing innovative solutions on a conceptual level. The project discusses 1) concepts of users and 2) methods for collaborative involvement. The first discussion involves presentation of an extended user concept and a discussion of differences between lead users and need-advanced users. The second discussion on collaborative involvement, discuss experiences with methods for communication across cultural and professional competences with reference to boundary objects, tangible systems and visualization. In the project four segments of situations for use of embedded technology in construction is analysed: the building process, professional operation and maintaining of buildings, tenants in social housing - and occupants/owners in detached houses. In the article the different methods for involving users are compared across these types of users.*

**KEYWORDS:** embedded technology, user driven innovation, need-advanced users, boundary objects, tangible systems

## INTRODUCTION

Several studies has pointed out that embedded technology in building materials might have beneficial results: in the building process itself and for operation, maintaining, the residents and end-users. But developing new products based on embedded technology in building materials is a case of complex products, no single part get the benefit and therefore no single part want to invest in developing the new products. Therefore the market alone don't seems to drive the innovation.

In the BIIB project several of the actors in such a process of development were brought together. The BIIB-project was carried out by the Danish Building Research Institute (SBI), Confederation of Danish Industry, Building Materials and IT and 30 firms from the organisations.

### An extended concept of users

Identifying the *actors* participating in user driven innovation the BIIB-project has involved four types: end-users – other stakeholders – developers – and the project team. Each part has an important function in developing innovative products. And each part has its own cultural and professional competences, agendas and interests. Therefore the need for tools for communication and knowledge sharing across these social settings was high.

### From Lead users to Need Advanced User

Central in the understanding of how to work with users is the concept of lead users, originally lanced by von Hippel and von Hippel & Katz. For them lead users were in front both concerning their needs and in finding solutions to those needs. In BIIP it was distinguished between lead users and other users which are in the forefront concerning needs, but not concerning technological based solutions - the term Need Advanced Users, was chosen for these users. These types of users will often be on front at a structural pattern; they possess the needs of tomorrow on a scale not immediately connected with technology. Demands to life, family, children, leisure time, working life, personal development etc., - that only difficultly can be solved in today's setting.

### Selecting the Users

In the BIIP project users were defined all through the value chain. In BIIB four scenes and segments of end-users was selected: 1) In the building process: The men/women at the building site; workers and building managers. 2) In building operation: The professional operators and services providers. 3) In dwellings: Tenant and administrators. 4) In detached houses: Tenants, which also is owners, operators and investors

These users were seen as end-users, which might benefit from the new type of building materials on different topics and needs. These end-users were

typical need advanced users, but included lead users as well.

### Selecting other Stakeholders for Validation of Scenarios

The success of innovation is not only a case of needs meeting the right solution, based on collaboration between developers and users. A chain of external stakeholders do have significant importance, ex as part of legislation, insurance, finance, purchasing, designing, advice as described before. In BIIB such external stakeholders was invited to participate in validation of the scenarios, where context, needs and solutions was presented.

### Collaborative communication, boundary objects and tangible systems

Collaborative processes involving actors from different cultural and professional setting demand tools for communication. Boundary objects and tangible systems were used to support the communication and knowledge sharing across such social and disciplinary/ professional boundaries (see ex. Brandt, 2005; Carlile, 2002; Star & Griesemer, 1989, Hornecker, 2005).

*Scenarios* were produced based on interactive studies of end users. The traditional *focus group meeting* was combined with ethnographical methods such as “interviews”, “walk through” and “photo safari”. The facilitated meetings took place at the end-users own territory (home, work space etc.). In the explorative dialogue in focus group meetings between users, developers and project team were used illustrated cards and plates as methods to supplements the interview themes as means for enforcing knowledge sharing and collaboration. The scenarios was used to support the understanding of social context, needs and solutions and knowledge sharing between users, developers, other stakeholders and the project team in a dialogue meeting. *The validation of the scenarios* and the generation of ideas and concept took place at *dialogue meetings* with end-users, developers and stakeholder from the entire value chain.

*Design games* were used in the collaborative process of developing *concepts for the new products* which took place at the *dialogue meetings*. As a central mean of tangible and informative communication in the dialogue meetings post-its and table- or wall sheets were used as a supplement or documentation to the oral inputs. These tools may be seen as boundary objects with an element of tangible systems concerning the hands-on situation which was partly established in the design game situation as well as in the use of post its.

### Conclusion

The methods used suited their purpose well. The visualized scenarios functioned as boundary objects and were crucial in order for different participants with very different background to understand context, needs and solutions. Design games functioned as a help-tool to concretise abstractions, ideas and concepts. The games functioned as boundary objects with a tangible element – cards to be drawn, post-its to be written and placed. The collaborative process succeeded in getting the active participation across disciplinary and cultural boundaries. It was found that the *end-users* actually were active and willing to expose themselves, their lives, and needs at the focus group meetings. The project identified different aspects of their life, and the interplay between interview, dialogue and actual showing of the context worked well. The *other stakeholders* participated actively in the dialogue meetings in order to validate scenarios and to generate ideas and concept. The participating *developers* continued the collaborative process, despite the financial crises which reduced resources but augment the need for innovation. Half a year before ending the project at least one product was demonstrated, and 6 firms had participated in commercial match-making activities on new embedded products facilitated by the BIIB project.

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# DATA ORGANISATION IN CONSTRUCTION – AS AN AID TO THE USER

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*The basic assumption in this paper is, that it will be possible to organise data in construction in a non-hierarchical way, following the lines of facet-based classification. This involves tagging data in a horizontal rather than a vertical order. Theoretically the paper builds on "classical thinking" represented by the work of Linnés, and connects to contemporary theory on facet-based classification. We have experienced a long and intense discussion of how to organise data. At a glance the discussion can seem to be merely technical but indeed it involves a broader perspective regarding different understandings of how to perceive, present and organise knowledge. Actors (consultants – contractors) present solutions, appropriate in relation to their own specific needs, but at the same time they can be difficult to use for other actors. Facet-based classification has not affected the thinking in the construction industry. Presumably this is due the mental dominance of hierarchical thinking, and the (earlier) cost of computer hardware. Today it seems obvious to take the facet-based approach into consideration, making it possible to specify ordering of data to the users' practice and frame of reference, rather than fixing the structure of data already when they are saved to the system.*

**KEYWORDS:** Data organization, Hierarchical classification, Facet classification, User interface, Data filtering

## INTRODUCTION

There seems to be a widespread understanding of BIM as a model gathering and carrying all possible information's, and with the key object representing the physical component. Hence, the classification is primary based on the physical component, and is intended to fill out all parts needs.

This approach is useful for some, but not necessary for all, and in praxis it tends to require that all parts have the same product based point of view. This common point of view will probably be easy to communicate when explaining the idea of BIM but will not benefit the core business of the different partners.

## FACET-BASED CLASSIFICATION

Although examples of facet-based classifications have been used for some years in applications on the Internet (Hearst, 2006), it has not affected the thinking in the construction industry.

Taylor describes facet classification as different from a traditional approach as "(it) does not assign fixed slots to subjects in sequence, but uses clearly defined, mutually exclusive, and collectively exhaustive aspects, properties, or characteristics of a class or specific subject. Such aspects, properties, or characteristics are called facets of a class or a subject..." (Taylor, 2006).

Both Taylor and Vickery connect the breakthrough of facet classification with the upcoming electronic

data processing. Today's huge internet-based database systems, used for e-commerce, are based on facet classification. Special studies of interface design used in facet-oriented systems have been produced, to facilitate these systems (Hearst, 2006). Ideally it should not, (for web purpose) be necessary to know a certain subject area and its break-down in sub-discipline in order to retrieve relevant information (Broughton and Clivic 2007).

## BIM as the partners communication

With the introduction of BIM, the consultants has establish his own basic point of view, and a quick look on the home site of Digital Construction ([www.detdigitalebyggeri.dk](http://www.detdigitalebyggeri.dk)) reveal a concentration of digital news, terms and stories of 3D virtual models of physical building, and very little of BIM as a non-physical phenomenon, collections of task descriptions and very little about the actual use of BIM data in maintenance.

## POINT OF VIEW

Economics, needs or functions and physical objects can be assigned to different orders, and sub-divided dependent on the situation. If the architect wants to examine a possible change in the functional model, caused by a change in the physical solution, it is necessary to arrange one data type, so it may correspond to another data type. Whatever triggers the activity of rearrangement, it is a question of comparing different types of views, to make it possible to see deviations. Hence, one point of view model must not just be an automatic extract of

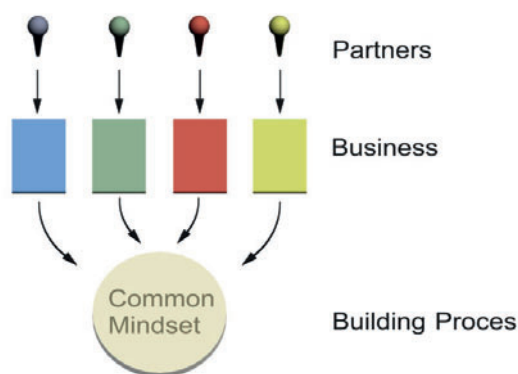


a primary model, because each point of view model is closely connected to one partners business.

If a BIM model must be able to contain information for all partners, the size will be considerable. This is not a technical problem, which is one of the reasons that gave inspiration to the idea of an all-in-one model. The mind-set is a renaissance idea in a modern digital form.

All information in one model requires one mind-set among all the model users, a nearly impossible situation. One model, representing both needs, functions, economics and the physical, will base its objects on one type of representation, e.g. the physical, and that will create dependency of this specific representation. A building can be represented as needs to be fulfilled, a result of functions or a result of investment, the list can be continued. Each representation will have a specific purpose, and must be sorted accordantly. This kind of order can be obtained by two approaches: 1. The partners agree on a common understanding of order. 2. Each partner provides own order.

Figure 1: An alternative BIM vision could be as a collector the necessary information between the partners.



## NEW DEMANDS AND NEW POSSIBILITIES

It is obvious that the level of complexity in construction is high. This is relevant both for what factors the different parties (client, facility manager etc.) finds relevant and in relation to where on timeline you approaches the process of construction. A classification approach has to deal with this complexity – or be more specific the changes in perspectives due to shift in actor and due to localisation on the timeline – it has to be flexible.

Where the partners in the construction industry sees itself as pearls on a string, the introduction of BIM, with all this entails, make it more relevant to consider the partners as consistently present facets of a continuous process. This change in perception

of positioning can be a major challenge for each party than the choice of technical solution.

A review of the partners internal organization, will involve a review of data. Where data can be structured in the interests of logic of data itself, the data can also be structured from a logic based on its use, in this case each party's needs with due regard to the other partners. These two logics are not necessarily contradictory, but require that the focus of the discussion concerning data organization, involving data use.

## CONCLUSIONS

Weather BIM is organizing the construction data in one way or and other, it will be a massive mass of data. The problem is not to generate data, but to pick out relevant data, in other words, to filter data in a proper manner and at a proper point.

To do this we need two things. A way to organize data, making it more searchable and available, than in the hierarchical system, and a filter mechanism as a universal user interface, which on the one hand can create an interface between the users perception and context, and on the other hand function as a dedicated search engine.

To achieve a common mind-set, without ending in the discussing about the chicken and the egg, every part must play with two balls. Where the first ball is a change or revision of own organization the second is the consideration for the other parts and their needs. This is more possible with a flat data structure, because it does not require that everyone agrees upfront. With the flat data structure no single party set the agenda and that each party can optimize their own business and that all parties contribute more specifically to the overall process.

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# MAPPING INNOVATION – FACILITATING INNOVATION IN THE DANISH CONSTRUCTION INDUSTRY

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*By adopting a theoretical framework from strategic niche management research (SNM) this paper presents an analysis of the innovation system of the Danish Construction industry. The analysis shows a multifaceted landscape of innovation around an existing regime, built around existing ways of working and developed over generations. The regime is challenged from various niches and the socio-technical landscape through trends as globalization. Three niches (Lean Construction, BIM and System Deliveries) are subject to a detailed analysis showing partly incompatible rationales and various degrees of innovation potential. The paper further discusses how existing policymaking operates in a number of tensions one being between government and governance. Based on the concepts from SNM the paper introduces an innovation map in order to support the development of meta-governance policymaking. By mapping some of the most influential trends and promising niche innovations and relate these to the existing regime, the innovation map can act as a medium in which policymakers, interest organization and companies can develop and coordinate future innovation activities.*

**KEYWORDS:** Innovation, policymaking, niches, SNM, sector development

## INTRODUCTION

Based on strategic niche management research (SNM) the paper presents an analysis of the innovation system in the Danish construction industry (Thuesen et al 2011) and discuss strategies by which innovation activities can be stimulated and coordinated.

## THEORETICAL FRAMEWORK

Theories within SNM look upon innovation in a sector as a socio-technical phenomenon and identifies three levels of socio-technical interaction within which sectorial innovation can be explained (Schot and Geels 2008) as illustrated in the following figure (p. 546).

Niches form the micro-level where radical novelties emerge. The socio-technical regime forms the meso-level, which accounts for the dominating stabilized socio-technical pattern of interaction which is reproduced by institutionalised learning processes. The macro-level is formed by the socio-technical landscape, an exogenous environment beyond the direct influence of niche and regime actors (e.g. macro-economics, deep cultural patterns, macro-political developments).

## METHOD

The collection of empirical material for analysing the innovation system draws on multiple sources like qualitative workshops, semistructured interviews, existing analysis and analysis of central texts.

## FINDINGS

The analysis shows a multifaceted landscape of innovation around an existing regime, built around the existing ways of working and developed through generations. The regime is challenged from various niches and the socio-technical landscape through trends as globalization. Three niches (Lean Construction, BIM and System Deliveries) are subject to a detailed analysis.

### Niches represent different rationalities

In line with Jensen et al (forthcoming) the niches are found to have partly incompatible rationales as illustrated in the following figure.

Figure 1: Innovation explained in three levels

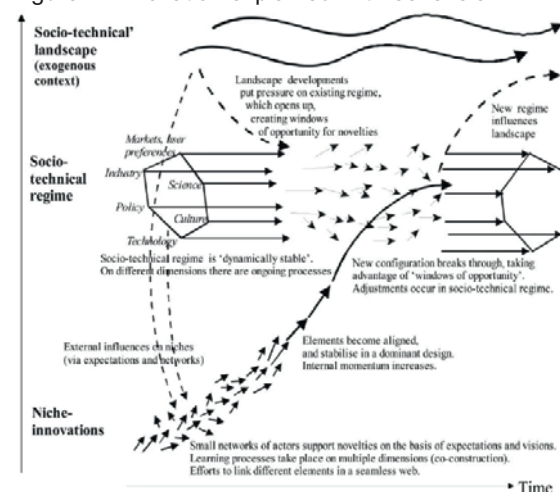
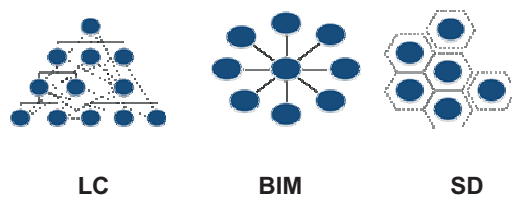


Figure 2: Different rationalities of the niches



### ...radicality...

While the niches have different rationalities, they are also major differences in terms of radicalism. This is supported by a combination of the various dimensions of compatibility between the niches and the overall regime as illustrated below.

Table 1: Different radicality of the niches

Dimension	LC	BIM	SD
<i>Technology</i>			
Production	Green	Green	Red
Optimization of design-production	Yellow	Yellow	Red
Application of IT	Green	Red	Yellow
<i>Industry</i>			
Value chain	Green	Green	Red
Design and production	Green	Green	Red
Driver of development	Yellow	Yellow	Red
Focus	Green	Green	Red
Variance	Green	Green	Red
Design-production	Green	Green	Red
<i>Policy</i>			
Political focus	Red	Green	Red
Use of standards	Red	Green	Red
Participation of Interest organisations	Yellow	Green	Red
<i>Culture</i>			
View of buildings	Green	Green	Red
Perception of the building process	Green	Yellow	Red
Collaboration	Red	Yellow	Red
Learning vehicle	Green	Green	Red
Development culture	Red	Green	Red
<i>R&amp;D</i>			
National research activities	Red	Yellow	Green
Development horizon	Green	Green	Red
Origin of research	Green	Green	Red
Educational anchoring	Green	Yellow	Red

### ...and innovation potential

The differences in compatibility offers different potential for sectorial innovation, while Lean Construction tries to change the regime from within reproducing the existing building practices (*reproduction*) system deliverances fundamentally tries to reorganize the regime from outside (*transition*). In between these BIM is trying to digitalize the existing regime while not fundamentally changing the organisation of the industry (*transformation*).

### New policy practices - mapping innovation

The conflicting rationalities among the niches internally and towards the regime put emphasis on development of policy practices and tools, which will be able to handle these differences.

Such practices should be based on analytical skills to identify, conceptualize and organize existing and new niches' rationalities, focus on developing strategies and allocate resources to informed experimental activity and anchor community formation around the niches.

A central premise for the facilitation of innovation through in this perspective is the development of a "language" through which the industry can understand and articulate innovation and strategies. Here it is appropriate to draw on the theories presented in the paper. Through concepts as niches, regimes, etc. these theories offers a typology which can be ordered in a map. Such a map could provide an overview and orientation points for navigating in the innovation system. Moreover, the map could clarify the interfaces of key players such as the different interest organizations and governmental institutions. Consistency and transparency in the innovation activities can be developed internally among government agencies and between public and private players including construction companies. This will enable the construction industry quickly to respond to new innovation opportunities locally as well as globally.

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# RENOVATION AS A BUSINESS OPPORTUNITY

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*Today, the dominant issue regarding the building stock is the challenge to cut greenhouse gas emissions. The question of whether old buildings should be rebuilt or renovated has been a key focus of research and literature. The rebuild option should result lower renovation activity than has expected. Renovation could, however, be a growing market if the building stock is upgraded. The focus of the study is commercial renovation, which has been analysed from the demand-supply perspective at the industry level. The construction economics and evolutionary economics theories have been applied to the analysis of demand and supply, respectively. The main research material consists of three cross-sectional surveys and official statistics. Renovation covers a diverse range of business sectors. In some of these sectors the customers, operating methods and building technologies used are virtually identical to new construction. The development of information technology and production technologies has helped construction sector companies to meet this type of demand in both markets. The best companies of traditional construction sector companies have preferred new construction to renovation. This contributes the rebuilding option.*

**KEYWORDS:** building stock, refurbishment, renovation, evolutionary economics, industry

## INTRODUCTION

The significance of the built environment as both one of the key causes of climate change and as a key means of mitigating it has boosted research into how to transform existing buildings into energy-efficient buildings. The need to renovate building stock in Europe will be driven by directive 2010/31/EU on the energy performance of buildings.

Repairing the built environment is not an end in itself; it is a tool for producing the kind of environment which people, society and businesses want and which functions well. For companies in the construction sector, renovation presents an opportunity to reform operating practices and business functions..

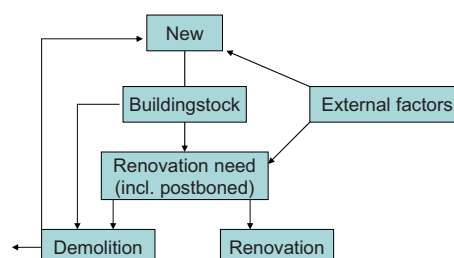
## THEORETICAL APPROACH

In this paper I aim to find out how the supply of commercial renovation services meet demand. The study focuses on the point in the lifespan of a building at which, for technical or functional reasons, a need for renovation exists, and on buildings which have future use potential. In some cases, changes are sought for buildings that are in otherwise good condition. Premises which have fallen out of use are transferred to new ownership prior to the decision moment or are demolished.

The *owner of the building* either postpones renovation work, renovates the property, or demolishes it in order to erect a new building in its place (figure 1). Companies, the public sector and private households base their renovation decisions on the same grounds as new construction decisions. A special characteristic of renovation is that it is aimed at the *existing building stock*. Demand for

renovation services can therefore also be created based on requirement. The availability of *financing* is a fundamental requirement for realising this demand. The *operating environment* also influences the demander's decisions.

Figure 1. Decision options on the demand side.



According to evolutionary economic theory, renovation can be interpreted from the point of view of companies as a *traditional market* or as a *new market* requiring *development*. If supply side suffers lack of demand or need entirely new customers, it can arouse demand by developing new, attractive products and services.

## COMMERCIAL RENOVATION

At the beginning of the 80s most renovation projects were carried out by building owners or their organisations. For this reason, developers, designers and the construction industry did not even consider building renovation as construction activity. (Lehtinen & Pajakkala, 1982)

Projects in receipt of public funding in the 90s were required to involve skilled labour in their planning and implementation. This requirement increased

the share of commercial renovation to seventy per cent. (Vainio et al. 2001)

Table 1. The development of renovation markets (Official Statistics of Finland; Vainio et al. 2000).

	<b>Building renovation % / new %</b>	<b>Commercial renovation per total renovation %</b>
1980s	25% / 75%	25%
1990s	35% / 65%	40%
2000s	40% / 60%	70%
2010s	45% / 55%	~ 75%

Around half of all commercial renovation is carried out by construction sector companies with more than 20 employees (Official Statistics of Finland). The remainder falls to small Finnish or Estonian companies under 20 employees in size and self-employed professionals. This is the main reason why many of the problems that existed 30 years ago persist even today. Larger companies have shown little interest in renovation due to the high levels of activity in new construction. Globalised investment markets have made it easier for companies to secure financing for new construction.

The energy saving potential of the building stock has been assessed internationally as well as in specific Finnish studies, and the theoretical models indicate significant potential. Upon closer examination, however, it becomes evident that the proposed measures are economically untenable; recently renovated buildings are not worth immediately re-renovating, and the proposed renovation measures are prevented, for example, by the existing structural solutions.

Now that the dust is settled, the Finnish recommendations are now in favour of making energy efficiency improvements primarily as part of standard renovation work. Few renovation or refurbishment measures aimed at improving energy efficiency can be cost-effectively carried out independently. (Heljo et al., 2011)

## CONCLUSION

These policy recommendations lead us back to the original need to develop the renovation sector.

Renovation research has focused on the building stock and on developing tools for property owners. This approach has been appropriate for property owners who have own organisations to carry out needed renovations. If renovation services are outsourced, the companies providing the services must be involved in the development work.

At its simplest level, the construction delivery chain includes design, product pre-fabrication, and assembly on site. This delivery chain has been jointly developed across organisational boundaries. Whilst information technology is an essential tool here, the most essential factor is the chain's desire to operate together to achieve the desired end result.

Energy efficiency poses new challenges for renovation. These challenges are shared in part with new construction. The global market offers products and components which can be combined to provide solutions to the renovation needs of customers. In many cases process and value innovations are needed instead of product development.

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# CONSTRUCTION PROCESS RELATIONS: EMPIRICAL STUDY OF FORMS OF CONTRACTS IMPACT ON PROJECT SUCCESS

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*This study sets out to investigate the impact of different forms of contracts impact on the project outcome, through a multiple case study of construction projects. Generally a project may be regarded as successful if the building is delivered at the right time, at the appropriate price and quality standards, and provide the construction client with a high level of satisfaction. However, as much as 60-80% of the gross work done in the construction industry involves the buying-in of material and services from suppliers and subcontractors. Therefore much effort is spent on procurement procedures. In Sweden construction contracts between the client and the main contractor are mostly based upon two form of contracts such as, the AB 04 (Design Bid and Build) and ABT 06 (Design and Build). The result of this study indicates that the projects success is not depending on the form of contract. Of more importance is that construction client's recognize the positive and sustained contribution they have to make if buildings of excellence are to be the norm rather than the exception*

KEYWORDS: Form of contract, Project management, Project relations, Procurement

## INTRODUCTION

A project may be regarded as successful if the building is delivered at the right time, at the appropriate price and quality standards, and provide the construction client with a high level of satisfaction. As much as 60-80% of the gross work done in the construction industry involves the buying-in of material and services from suppliers and subcontractors, for which reason they have a heavy impact on most kinds of construction products (Dubois and Gadde, 2002, Miller et al., 2002). Generally, the procurement strategy is therefore considered to be important for the success of a project and one part of the procurement strategy is to choose a suitable form of contract. A contract is a way of creating a project organisation according to Levitt & March (1995) by transforming a conflict (political) system into a cooperative (rational) one. However Loosemore & Huges (1998) argue that standardized procedures are more helpful when the nature of the task is simple, whereas as task complexity and time pressure increase, standardized procedures can become restrictive and counteractive.

Similarly, Chan & Chan (2004) and Baccarini (1999) suggest two levels of measurement for project success; the first is an objective measurement such as time and cost related to the specifications in the contract. The other level of measurement contains of a more subjective dimension, for example expected quality (both client and users expectations) and functionality. Collins & Baccarini (2004) claim that the objective dimension is connected to the project management success and the subjective to product success, that

is, the effects of the project's final product Poor definition and weak articulation of product requirement may, however, result in dissatisfied customers even when project specifications are fully met (Atkinson, 1999). To further understand how different form of contract affect project performance this study sets out to investigate the characteristics of the construction process and the management of relations in the construction process in relation to the two main forms of contract used in the Swedish construction sector.

## Characteristics of relations in construction

Swedish construction contracts are frequently based upon standard rules worked out jointly by client federations and the Swedish Contractors' Federation. For example, the AB 04 (Design Bid and Build, DBB) regulation is applicable to contracts in which the client has the main responsibility for the design of the project, whereas the ABT 06 (Design and Build, DB) regulation is applicable for contracts where the responsibility for the design is distributed to the contractors. Both of these contract regulations, DBB and DB, are mainly based on classical transactional models of governance. Accordingly, they attempt in detail to spell out the responsibilities, authority, and compensation of each part in detail. The use of standardised contracts thereby enables parties to reduce the emphasis on specific contractual terms during the negotiation process. However, they also create difficulties for clients to assess the tender of a specific project since the comparison of tenders is based on the predefined apportionment of risks (Murdoch and Huges, 2007). In addition, the construction clients need to recognize the positive and sustained contribution from contributors in the



project rather than distributing the risk by contractual arrangement.

## RESULT FROM THE EMPIRICAL STUDY

This section describes the empirical evidence conducted with clients that are involved in pilot projects financed by the Forum for Building Costs (The National Board of Housing, Building and Planning). The criterion for the nine selected projects was that they all were aiming to result in an actual physical product. The empirical material was obtained through one interview, and follow up questions after the interviews, with each of the involved construction clients and studies of documents concerning the projects. The main findings show that there is a predominance of development of the construction process, tendering procedures and procurement methods in the sample; just a few projects had a clear technical focus. There is also a variety regarding the described focuses in the project, from highly divided contracts to partnering.

One significant word that appeared during the interviews was “certainty”. The respondents wanted to be confident with the end result of the construction process, which they referred to as a balance between cost and quality in the projects, quality that was based on user demands. Another significant similarity was that they were not interested in building “cheap” products. They instead referred to products “worth their price” (By products “worth their price” they referred to a balance among cost, level of quality, location and level of rent). All the respondents also re-emphasized the importance of being an active client, by a more personal commitment and by being well informed. A common feature of the projects was the involvement of the participants early in the process and on the question of the contractual arrangement, the use of standard contract, the respondents referred to them as a “security” if any conflicts would arise during the project time.

## CONCLUSIONS

This study does not try to define exactly what a successful project is. Since the projects are displayed publicly as “best practise” for other to be inspired of, the assumption in this study is that the investigated projects are to be regarded as successful. The respondents also referred to the question on project success that the project results were satisfying on their behalf and the similar view can be found in the written reports. the different construction clients had the same “picture of the problem”, that is, they were all very keen on delivering the right product to the market, with the right balance between cost and quality. The effect, though, of a specific form of contracts on the

project success could not be distinguished on the in this study. This finding indicates that time and cost needs to be seen in the light of business achievement for the project in order to measure the project success. Also significant is that the focus in the project was on individuals involved in the project rather than the specific form of contract. That is, the management of the relations in the projects is of great importance for project success. Thus, the standard contracts are of course important if any conflicts arise, but of more importance is to create a project environment that supports the collaboration between the project participants.

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# FRAME WORK FOR QUALITY IMPROVEMENT OF INFRASTRUCTURE PROJECTS

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*In order to achieve high quality that not only gives acceptable return value to society but also satisfies the needs of all the stakeholders of infrastructure projects, comprehensive understanding of issues pertaining to the quality of the project is needed. The aim of this study is give an overview the most common procurement methods used in constructing infrastructure transport projects and analyze how these methods contribute to the desired quality of the final product in relation to client competence. An on-line survey of construction actors was carried out to ascertain quality level of Swedish infrastructure transport projects and determinant factors of quality problems. An equal number of respondents indicated that the quality of infrastructure projects has either increased or remained same level over the past twenty years. They also pointed out lack of client competence that is vital in realizing the desired quality level through proper procurement, monitoring and evaluation procedures. Public clients heavily rely on traditional design-build procurement that requires considerable client involvement of a project. Thus, the association of quality problems and lack of client competence may not be a mere coincidence but an overlooked outcome of current situation.*

**KEYWORDS:** Competence, infrastructure transport, procurement, quality, warranties

## INTRODUCTION

The Swedish construction industry is facing a shortage of skilled workers and ageing of existing staff (FIA, 2005). Since quality performance and the effectiveness of any selected procurement method partially hinges on the competence of client's workforce, it is crucial to examine how different procurement methods could be affected by the scarcity of client competence, experience and expertise. The aim of this paper is to give an overview the most common procurement methods used in constructing infrastructure transport projects and analyze how these methods contribute to the desired quality of the final product in relation to client competence. Identifying some of factors that are associated with quality problems i.e. lack of competence and at what stage of the construction process that these factors are critical will allow us to contemplate which procurement method is appropriate to certain situations.

## LITERATURE REVIEW

A survey conducted by the International Federation of Consulting Engineers (FIDIC, 2004) found that decreasing quality of construction is a worldwide phenomenon that is mainly caused by inappropriate mechanism of project delivery such as poor consultant and contractor selection, bad design, poor project supervision and inadequate material and workmanship. The FIDIC (2004) finding also highlights the importance of client competence during the planning and design stage as well as during the tendering and construction stages. During the operation and maintenance phase, assessment of the quality is challenging since the expected life of many infrastructure projects is

quite long. A survey of Swedish Transportation Administration (STA, 2010) exemplifies the difficulty of ascertaining reliable measurement of satisfaction level from road users. The survey found that drivers were not only dissatisfied with road conditions but also private and professional drivers have different opinion about the level of dissatisfaction.

## RESEARCH METHOD

After a pilot survey with a number of practitioners and academics in the field of construction, an on-line questionnaire containing 29 questions was sent to 128 selected respondents (45 contractors, 35 clients, 37 consultants, and 11 regional traffic offices). After few questions related to the information of respondents, respondents were asked their general assessment of the quality problems today and the past. The rest of the questions of the survey were statements that are intended to ascertain important attributes such as competence of construction actors, project characteristics etc. that may have contributed quality problems or lack of quality improvement. Respondents were also asked to comment on each question and statement in order to solicit their candid view about the quality of infrastructure projects.

## FRAME WORK FOR QUALITY IMPROVEMENT

Brockmann (2009) argues that construction projects such as buildings or infrastructure are typically quasi-credence goods meaning that their qualities are ex-ante intangible but ex-post tangible. Construction goods do not exhibit search qualities

since the quality of construction goods cannot be determined at the time of signing contract (Brockmann, 2009). However, once the contract is carried out and the project is completed ex-post search qualities could become tangible. Similarly, construction goods also differ from experience goods since experience qualities are based on a high frequency of contracting between the same client and contractor (Brockmann, 2009). On the contrary, Vassallo (2007) argues that quality of most of infrastructure projects are observable after their use and classified them as “experience goods”. He claims that infrastructure quality is verifiable though the cost of measuring quality is not usually low.

There are distinctive competencies that are highly required when client is employing a specific procurement method. Client is expected to have enough manpower resources with appropriate skills and expertise in different areas such as financial, technical and contracting management. A resourceful client organization could use extraordinary technical competencies and expertise to transform experience qualities to search qualities or even credence qualities to experience qualities. This transition between types of qualities would have certain implication on how client selects appropriate procurement methods. Thus, the above representation could improve understanding the impact of different procurement methods on client’s workforces and their skill development.

## PROCUREMENT METHODS

Procurement methods are often classified based on how construction activities such as design, construction, and operation and management are delegated among actors in the project. Different financing options of infrastructure projects also influence this classification. Love et al. (2008) classified the following four procurement systems; traditional (separated), design and construct (integrated), management (packaged), and collaborative (relational) such as PPPs.

## RESULTS AND DISCUSSION

According to the respondents, quality of construction projects constructed in last five years is either at the same level or even better than the quality level of projects built twenty years ago. Same numbers of respondent (44%) believe that quality level is higher today or has not changed during this period.

Responses from the questions related to competence of client with regard to quality problems of infrastructure projects were very strongly negative. Respondents indicated that client’s lack of competence is major factor of quality problems of infrastructure projects.

Approximately 82% of respondents partially or totally agree when we stated that the quality problem in the finished structure is highly dependent on the client's competence. Similarly, 72% of them indicated that tendering documents contributed quality problems of final product. Respondents also pointed out (80% of them) that designers of the project play a major role on the quality problems experienced in the finished project.

## CONCLUSIONS

As our survey and other previous studies mentioned in this paper indicate, lack of client competence is one of the factors that contribute quality problems of infrastructure projects. Traditional procurement method, which is the most common method used by the Swedish Transportation Administration (STA), demands the highest client involvement in the project compare to other procurement methods. In light of shortage of skilled and experienced workforce in the public sector and the heavy reliance of the sector on this traditional procurement, it is plausible to assume that the association of quality problems and lack of client competence is not a mere coincidence but an overlooked outcome of current situation.

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# PROMOTING GREATER PUBLIC PARTICIPATION IN DECISION MAKING FOR INFRASTRUCTURE DEVELOPMENT PROJECTS: BUILDING SOCIAL CAPITAL THROUGH YOUTH ENGAGEMENT

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*Opposition against infrastructure projects and protests at construction sites are not uncommon, yet many governments in advanced democratic societies put a strong emphasis on public engagement and devote significant resources toward these programs. One of the more outspoken groups often appearing in these protests are youths in their late teens and 20's. How can young people be engaged more effectively so that a culture of greater public participation in decision making for infrastructure development projects can be nurtured? This paper aims to investigate and discuss: i) the level of understanding young people have about policies, products and technologies related to infrastructure development that can provide greater societal and environmental benefits (and their willingness to pay for them); ii) how to increase youth involvement in public engagement events for infrastructure projects; and iii) how to extract higher quality feedback and ideas from young people through partnerships with various networks within society (thus building social capital) to help decision-makers better incorporate them into the planning and design of infrastructures. Findings and observations from a youth engagement event on Hong Kong's policies and strategies on climate change (emphasizing on reducing greenhouse gas emissions in buildings and transportation) will be presented in this paper. The values and roles of networks within society to help promote greater public involvement in the decision making process for infrastructure development projects will also be discussed.*

KEYWORDS: public engagement, social capital, youth empowerment, public participation

## INTRODUCTION

Understanding how to engage young people more effectively on infrastructure development projects can help governments and policy makers improve engagement processes in the long term by nurturing a culture of greater public participation. Improving public engagement processes can also help mitigate project delays, improve mutual understanding amongst different stakeholders to reduce friction embedded in communities when conflicts of interests arise, and ultimately contribute to a more harmonious society. Public participation involving forums, exhibitions, surveys, etc., is often part of a phase within the planning process instead of a continuous effort (Sager, 1981). However, without constant connection and dialogue with the public, underlying issues affecting society may not be adequately addressed. It is particularly important for a city like Hong Kong (where public engagement is still at an infancy stage compared with places like Scandinavia) to promote greater public involvement in a place that lacks such participation from the community. The building of social capital (generally considered to be the value of the network relations within society) is suggested as a possible approach for reaching out to a larger audience to improve the engagement process and help nurture a culture of increased

public participation in decision-making for infrastructure development.

## CONDUCTING A YOUTH ENGAGEMENT EVENT

To understand how to engage youth more effectively, an engagement event titled “i350 Youth Summit on Climate Change” was planned and facilitated in collaboration with the NGO Envision Hong Kong and the Centre of Development and Resources for Students (CEDARS) at the University of Hong Kong in early October 2010. A total of 69 participants attended the event, which included young professionals, university and secondary school students. The public consultation document on Hong Kong's Climate Change Strategy and Action Agenda from the Environmental Protection Department (EPD) of the Hong Kong government served as the basis for discussion at the event. The proposed target was aimed at reducing Hong Kong's carbon intensity by 50-60% in 2020 compared with 2005 levels, and a set of strategies and action plans was proposed to focus on the three major sources of green house gas emissions in Hong: i) electricity generation (67%); ii) transportation (18%); and iii) waste treatment (5%) (EPD, 2010). A two-stage questionnaire survey specifically designed for this event was



administered; one before the event commenced (prior to the participants' active participation in discussing about the consultation points) and one after the event concluded. The purpose of the two-stage questionnaire is to find out if the participants feel differently (or more strongly) about certain issues or even change their minds after receiving more information and discussing in detail about the topics and issues being consulted on.

## KEY FINDINGS

The majority of the respondents (89.3%) believed that they can play a role in infrastructure development projects in Hong Kong by contributing their ideas. Although 65.5% of respondents were aware of public engagement events for infrastructure development projects or policies in Hong Kong, only 13.8% actually participated in those events. The upside was that after the participants' involvement in the discussion session, 95% of them expressed that they would consider participating in future public engagement events. This is a promising sign as it shows that these young people have the desire to make a contribution and are willing to participate, provided that they are properly engaged. As expected, social network websites (such as Facebook and Twitter) were considered the most effective channels for the government to engage youth (62%), while other traditional forms of engagement like school visits by government representatives, consultation forums and written comments lagged behind (48.3%, 44.8% and 37.9%, respectively).

Participants were also asked about their willingness to pay extra (before and after discussion) for: i) electricity generated from renewable energy sources such as solar or wind; ii) more environmentally friendly construction materials for their homes; iii) more environmentally friendly transportation technologies; and iv) paying higher taxes for the government to use more environmentally friendly construction materials for public infrastructures or buildings. In general, there was a shift towards a greater willingness to pay in all categories after the participants had a chance to read through the consultation document and discuss with their peers. The most notable changes in willingness to pay extra were from the 1-5% to 6-10% intervals. The opinions of participants regarding the EPD's public consultation document were collected and summarized in a report submitted to the Environment Bureau on 10 December 2010.

## CONCLUSION AND DISCUSSION

Rather than focusing solely on the relationship and transfer of information between the government and the public, it is proposed in this paper that certain networks and organizations within society

can be mobilized to serve as a vehicle for this information transfer and expand communication channels with citizens to reach out to a larger audience. The i350 Youth Summit on Climate Change brought together young professionals, university and secondary school students to discuss the problem of climate change and the actions and policies needed. This event indicated that partnering with networks within society can help engage young people from society, many of whom would have otherwise not participated or responded to public engagement events. By reaching out and empowering the participants with knowledge, tools and a channel for them to share their views, the participants were outspoken and willing to offer their opinions and voice their ideas.

For the Hong Kong government to successfully commit to a public engagement-based approach to policy making and setting development goals (as outlined in the Policy Address for 2010-11 and in previous years), it is imperative to proactively engage youth in order to develop and nurture a culture of greater public participation in the decision-making process. Various stakeholders and networks within society such as NGOs, NPOs, construction industry coordination bodies, professional associations and institutions and education institutions can all play a role to help to bridge the knowledge gap between the professionals involved with designing and building the infrastructures and the broader public.

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# COMPARATIVE STUDY OF DANISH PREFAB HOUSES MADE OF WOOD

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*The use of wood in Danish prefab building projects is increasing, but there is not a strong architectural tradition in Denmark for constructing timber housing. This paper therefore contains a comparative study of various manners of incorporating architectural features in prefab houses made of wood. In the study four Danish prefab housing concepts based on wood construction is compared and discussed, in order to investigate and exemplify how it is possible to work with architectural quality in prefab timber housing and maximise the use of the material, the prefab production and the architectural values. It was concluded that especially two aspects are of great importance for the concrete handling of the architectural quality of prefab houses made of wood; 1) flexibility in relation to user and site, and 2) the interaction between form, logics and material. It is suggested that keeping these two aspects in mind makes it possible to design prefab timber houses of good architectural quality in a Danish context.*

KEYWORDS: Prefabrication, quality, timber construction, communication

## INTRODUCTION

This paper aims to put into words the architectural potential and pitfalls of prefab houses made of wood. This is meant to be a support for communication and discussion between architects and other trades that use wood in prefab processes in a Danish context.

Wood is increasingly used in Danish prefab building projects as it is considered to be cheap, strong, environmentally friendly and easy to handle in prefab processes (Kraul & Madsen, 2007). However, there is not a strong Danish architectural tradition for building with wood. For the last century, wood has mainly been used as a building material for secondary or temporary houses, such as summer cottages, allotment huts, post-war house replacements and refugee camps (Lind, 1998). Therefore, the idea of a house made of wood is often connected with temporary buildings, whereas the idea of a permanent house is closely connected with the heaviness and robustness of brick or stone walls (Lind, 1998).

In the past decade several new manufacturers of prefab houses have emerged in Denmark. Some of them have introduced houses made of and with wood drawn by architectural offices (Juul, 2008); for example ONV and HP3 started manufacturing the ONV house. The ONV housing concept has a loadbearing construction made of wood and is built of 3D modules produced at a factory. However, a building can be prefabricated in a variety of ways and most building projects today use prefabricated elements to varying extents (Anderson & Anderson, 2007; Thorsen, 2005). As illustrated in Figure 3, building systems can be based on 2D or 3D elements and can be more or less open to

changes in relation to the specific customer and site. Industrialisation of architecture therefore brings up the question of to what extent a building should be specifically designed for the context and a specific customer (Anderson & Anderson, 2007). The builders, or the architects, often design and build for a customer unknown to them and to some extent also for a context not known to them in advance –prefabricated detached houses are good examples of such buildings. Many architects have rejected the whole idea of prefab building with reference to its rigidity in relation to aesthetics (Arieff, 2002; MacKeith, 2005) – maybe this is why only five per cent of the single-family housing stock in Denmark is designed by architects (Ingels, 2003), and both single-family houses, as such, and the suburban areas where they are situated are often accused of lacking in architectural experiences (Knudsen et al., 2000).

In this paper the architectural quality of Danish single-family houses is therefore analysed and discussed through a discursive, comparative analysis. Three theoretical approaches were used to develop a model of analysis that covered a wide range of aspects tied to architectural quality. The approaches of the model were concretised through an analysis of three unique houses that were often described in architectural literature as having good architectural quality. The model was then used to analyse four prefab building systems. Through a discussion, the architectural features of prefab building systems were compared with the architectural features of the unique quality houses. To conclude the paper, two main areas of interest were identified that were crucial when working with the architectural quality of prefab houses made of wood.

## CONCLUSIONS

Four Danish prefab timber building systems were analysed in order to investigate what factors were particularly important when working with this building typology. The systems were chosen to represent a wide spectrum of different methods of prefabrication – and thus there were both opened and closed systems, and constructions built from 2D and 3D elements, or combinations of these. It was concluded that **flexibility** and **experience of form, logic, and material** were the most crucial aspects for the architectural quality of prefab wooden houses. Flexibility was both a problem when there was too much of it and when there was too little of it; in a very flexible system it was difficult to make sure that all possible combinations would result in a well-proportioned and harmonious building, whereas in systems with only few possible ways it was difficult to adjust the dwelling to a specific site or user. Especially in two of the unique houses, there was much focus on the materials; how and where they were used in relation to functions and the constructional logic. In the analysed prefab houses, the detailing of the materials was less elaborate and they did not provide the same kind of experience of variety and meaningfulness in relation to the total concept of the houses. A focus on these two points - **flexibility** and **experience of form, logic and material** – covered many of the aspects that are important when working with prefab houses made of wood. Care and elaboration in relation to these could therefore add to the architectural quality of this building typology.

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# COST CONTROL AND SCOPE MANAGEMENT IN MAJOR NORWEGIAN PUBLIC CONSTRUCTION PROJECTS

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*The paper presents the results of a large qualitative study of 23 Norwegian government-funded projects executed in the period 2000–2010. A wide range of areas was examined in the project execution phase. In the paper we look at the findings and observations relating to the project owner role in the management of the project scope. The concept ‘scope’ includes features and functions of the project result as well as the work needed to realize the project. There will be uncertainty related to the scope in both of these dimensions. Scope management is about ensuring that the project delivers the scope necessary to provide the desired value, and not more. It is a process consisting of the basic activities of establishing a plan for reference, keeping control of progress, analysing deviations, and implementing changes. In the projects investigated, our observations indicated that scope management was not well taken care of, and we partly ascribe this to deficiencies in the project governance. The paper discusses findings from the study in the light of this theory, and seeks to point out key elements of improvement.*

**KEYWORDS:** scope management, change management, project governance, project management

## INTRODUCTION

In 2009 researchers at the Norwegian University of Science and Technology (NTNU) conducted a study of 23 large Norwegian public investment projects with the main objective of learning how the projects had performed in the execution phase. Of the 23 projects, 19 were construction projects.

The study showed that the projects had performed well. Out of the total a sample of 23 projects, 22 were delivered within their cost frame, 20 according to schedule, and 21 with a quality and capacity according to given specifications.

Despite this achievement, deeper investigations of the project processes revealed that there was still room for improvement. The researchers found that there was inconsistency in the project actors’ perceptions of principles and routines for handling and managing scope.

## SCOPE AND SCOPE MANAGEMENT

According to the Project Management Institute’s well-known *PMBOK* (Project Management Institute 2004) the term ‘scope’ can refer to both *product scope* and *project scope*. Product scope refers to the characteristics and functions of the project product or other project deliverables, and is often referred to as the specification of requirements. In contrast, project scope is the scope of work needed to realize a product or result with the given functions or features. Both product and project scope will be exposed to uncertainty, and must be handled accordingly. Some uncertainty

will be of an operational character, such as technical solutions or the volume of work necessary to realize the project results. However, there will also be uncertainty related to conditions in the project context, such as unstable external frame conditions, or uncertainty related to whether the chosen project concept actually will provide the desired value to the project owner (Kreiner 1995).

Controlling scope uncertainty and scope changes is a central part of the project management function. Scope management has been defined by Turner (2009, p. 101) as: ‘the process of ensuring that:

- An adequate, or sufficient, amount of work is done
- Unnecessary work is not done
- The work which is done delivers the desired performance improvement.’

In common with other management processes, the activities of defining a baseline for reference, controlling the project progress, and initiating changes as a response to deviations from the baseline must also be present in a scope management process.

The scope baseline is defined by the project objectives, specification of the functions and features necessary to meet the objectives, and the scope of work necessary to be undertaken to meet these requirements. It should also be clear what kind of uncertainty the project is responsible for handling. Keeping track of both project progress

and deviations from plans are well-known control activities in a management process. Changes of scope will inflict many of the other parameters in the project, such as time and cost. The consequences of a suggested change should be analysed to provide an information base before being approved and implemented.

As the one who orders the project, the project owner has the important role of governing the project. In the scope management process, the owner role will typically include the following:

- Define the project and project mandate, and set the other frame conditions and premises
- Approve major changes in scope, and other premises, such as time, cost, and quality
- Provide the project with sufficient resources.

## FINDINGS AND RESULTS

The findings and observations presented here relate to part of a larger study of 23 large Norwegian government projects, of which 19 were construction projects executed between 2000 and 2010. The projects in the sample had been subject to a special governmental quality assurance scheme during the planning phase, and the main objective of the study was to learn how these projects had performed in the execution phase. The findings and observations relating to the scope management were as follows:

- *Insufficient mandates:* some projects had ambiguous mandates or no mandates
- *Unclear limitations of responsibility:* lack of clear limitations of responsibility for handling uncertain external conditions or scope in the interface with adjacent projects
- *Immature concepts:* some projects had to be redefined after the investment decision
- *Improper cost estimates:* some estimates were based on assumptions which were too optimistic, and did not properly include the scope uncertainty
- *Scope changes without new resources:* projects were forced to make costly changes of scope without being granted extra funds
- *Lack of formal procedures:* some large scope changes were implemented without any formal changes in the project mandate
- *Transfer of scope:* in some cases elements of the project scope were randomly transferred to or from other projects or budgets

The observations presented above indicate that many of the projects were not properly defined.

Some projects had either ambiguous mandates or no mandates, while in other cases there was a lack of clarification of the project's responsibilities regarding handling uncertainty in scope or other premises. The researchers found signs of consequential unintended increases in scope.

Proper handling of changes was also deficient in many projects, and the projects often lacked routines and procedures to handle scope changes. Changes were sometimes imposed without any analysis of the consequences or revision of the objectives or mandates.

In the researchers' opinion, lack of proper project scope definition for reference purposes and insufficient change control are serious deficiencies in a scope management system. We believe this is due to the project owner's lack of project governance.

## CONCLUSIONS

The project scope includes both characteristics of the project result and the scope of work required to realize it. There will always be uncertainty related to the scope in both of these dimensions. Scope management is about ensuring that the project delivers results as initially agreed upon, and maximizing the benefit for the project owner and society. The scope management process consists of the activities of establishing a baseline for reference, controlling the progress, and responding to deviations by implementing changes in plans.

In many of the 23 projects investigated, we observed that scope management was not well taken care of. Some projects lacked a proper project definition for reference and follow-up. Further, the principles and routines for handling and controlling changes of scope were either not present or not consistently perceived among the project actors. Many of the deficiencies in the scope management can be addressed to a lack of proper project governance, which the responsibility of the project owner.

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